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Report on the Metropolitan Toronto Transportation Plan
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Report on

THE METROPOLITAN TORONTO TRANSPORTATION PLAN

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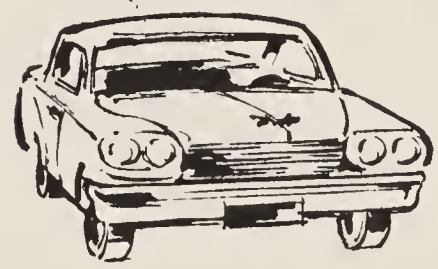

Report on

THE METROPOLITAN TORONTO TRANSPORTATION PLAN

Metropolitan Toronto Planning Board, December, 1964

Metropolitan Toronto Planning Board

790 Bay Street, Toronto 2, Ontario • Telephone EM 6-6263

Wm. A. Harris
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Vice-Chairman

E. Comay
Commissioner of Planning and
Secretary-Treasurer

W. Wronski
Deputy Commissioner

December 29, 1964.

Mr. William A. Harris,
Chairman, and Members,
Metropolitan Toronto Planning Board.

Ladies and Gentlemen:

We are submitting for your consideration the Report on the Metropolitan Toronto Transportation Plan. This report contains the findings of the transportation research studies which this Board has undertaken over the past several years and provides the basis for the recommended transportation plan in the Proposed Metropolitan Official Plan, which is presently also before you for consideration.

The staff has had the benefit of close cooperation from many persons and agencies in carrying out these studies, including the planning and roads officials of all of the local municipalities in the Metropolitan Toronto Planning Area. Particular acknowledgment should be given to our consultants, Mr. H. Blumenfeld and the Traffic Research Corporation Ltd; to the Metropolitan Toronto Roads Commissioner and Traffic Commissioner; and to the officials of the Toronto Transit Commission, the Planning Branch of the Ontario Department of Highways, and the Metropolitan Toronto and Region Transportation Study. The Department of Highways has made a substantial contribution toward the cost of these studies, and this is also acknowledged with gratitude.

While many persons have cooperated in these studies, the staff of this Board is solely responsible for the views expressed in this report and its recommendations. It is submitted to facilitate the consideration of the Proposed Official Plan by the Board and the Metropolitan Council, and also provides a basis for current and future recommendations on specific transportation facilities.

Yours very truly,

E. Comay

E. Comay,
Commissioner of Planning.

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INTRODUCTION

METROPOLITAN TORONTO AND REGION

INTRODUCTION

PURPOSE OF THE TRANSPORTATION STUDY

In January 1960 the Metropolitan Toronto Planning Board issued the Draft Official Plan of the Metropolitan Toronto Planning Area (1959), which projected the development requirements of the region over a 20-year period ending in 1980 and formulated basic land use, transportation and public works policies for that period.

It was recognized at the time that the proposed transportation system was only a preliminary plan which required systematic evaluation and expansion before it could be considered for adoption by the municipality and its constituent agencies. Subsequent to the publication of the Draft Official Plan, therefore, the Board undertook a comprehensive series of transportation studies, utilizing for this purpose the electronic Traffic Prediction Model which had been developed in conjunction with the Board's consultants.*

The present report has been prepared after the completion of the comprehensive transportation studies. Its primary purpose is to recommend the transportation system most appropriate for the anticipated development of the 720 square-mile Metropolitan Toronto Planning Area. The recommendations are based on an analysis of a series of studies which were designed to:

1. Secure a better understanding of the utilization and efficiency of alternative transportation systems;
2. Determine the influence which changes in certain operational features would have on the utilization of such systems;
3. Evaluate the preliminary Transportation Plan and recommend the necessary adjustments to best meet the objectives of the proposed Official Plan.

The results of the transportation research studies do not give a blueprint for the transportation plan, but are used to provide significant insights in the evaluation of plans previously formulated and to provide techniques for the preparation of future plans. Because of the uncertainties in predicting social and economic changes and the effects of other pressures which influence the rate of urban growth and its form of development, no transportation plan can at any time be considered as "final". The transportation system is developed as a series of projects, each of which is subject to detailed study, searching analysis on the political level, thorough and often protracted public debate, and modification in varying degrees as specific circumstances dictate.

The advantage of the procedure employed in this series of studies is that it provides a systematic framework both for the continual revision of current plans and the analysis and evaluation of specific problems. It is particularly useful because it supplies a dispassionate approach to the always vexing problem of public versus private transportation and thus affords the community an opportunity of working towards a balanced system. It must be emphasized, however, that techniques of projection and analysis, no matter how well reasoned or sophisticated, are no more than useful tools for accumulating knowledge and information.

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*The Traffic Prediction Model was developed by the Board and its consultants, Mr. H. Blumenfeld and the Traffic Research Corporation Ltd. For a description of the model and the methods used in its development see "Transportation Research Program, Report No. 1", published by the Metropolitan Toronto Planning Board in 1962. A short description of the model and the procedure used in the transportation research studies is given in Appendix A of the present report.

The transportation plan recommended here is only in part a result of the studies described in this report. It is equally a product of the detailed studies of community development which form the basis of the overall Metropolitan Plan. Perhaps most important of all, the transportation plan stems from the basic structure of metropolitan government in Toronto, which makes it possible to develop an integrated network embracing both public and private modes of transportation and which permits the area-wide approach which is essential to the establishment of a coordinated transportation system.

Chapter I

URBAN GROWTH AND THE DEMAND FOR TRANSPORTATION FACILITIES

The location and capacity of the transportation facilities required to serve the urban area are dictated in large measure by the total traffic generated by the various land uses, which in turn arise out of the level of economic activity, the historic pattern of development, and its planned projection into the future. The preliminary transportation plan for 1980 was based to a large degree on predictions of development and the analysis of future transportation demands arising from the anticipated urban development. The basic land use pattern and other factors governing the urban development of the area were elaborated in the Draft Official Plan, and are reviewed here to set the framework for consideration of the transportation plan.

POPULATION GROWTH AND DISTRIBUTION

The Metropolitan development plan derives from the basic assumption that it is not desirable or necessary to limit the growth of population or economic activity in the area to any arbitrary or theoretical "optimum" size, nor is it possible to do so utilizing existing municipal powers. The basic factors governing the scope of metropolitan development stem from the role which the area plays in the development of the Canadian economy. In the foreseeable future it is clear that the Toronto area will continue to occupy a pre-eminent position in the growth of the nation, serving as the country's major centre of secondary industry and as the financial, commercial and cultural centre of the nation's industrial heartland.

Assuming the continuation of national development policies which promote a high volume of immigration from abroad, and given a continuation of the area's attraction for domestic migrants and for a wide variety of manufacturing, commercial and service establishments, the continued growth of the area appears assured.

Metropolitan Toronto's share of the national population has increased steadily for many years, as is shown in Figure 1. It is expected that the area will continue to grow at a faster rate than either the Province of Ontario or the country as a whole, but for a variety of reasons it is likely that Metropolitan Toronto's share of the overall population will not continue to increase as rapidly as before. By 1980 the Planning Area is expected to contain about 10½% of the national population, compared to 9¾% in 1961, and 8½% in 1951. With an indicated growth rate of about 2½% per year, averaging about 55,000 persons annually, the population of the area is expected to reach about 2,800,000 persons by 1980, an increase of 55% over the 1961 figure of nearly 1,800,000. Of the projected total, about 2,300,000 persons will be living in Metropolitan Toronto, with an additional 500,000 persons in the surrounding fringe areas which are included in the Metropolitan Planning Area.

The distribution of population is expected to follow certain well-established density trends, which are illustrated in Figure 2. These indicate that while densities are generally lower as the distance increases from the centre of the area, over an extended period of time densities will tend to increase in most sectors of the area; furthermore, it is likely that sharp differences in density between adjacent sectors will tend to become less pronounced, and that over a period of time the density pattern will assume more uniform characteristics over wide belts of the Metropolitan area, as shown in Figure 3.

The rapid growth of suburban development which has characterized the area since the war is expected to continue unabated, and to extend well into the fringe areas by 1980. This trend is illustrated in Figures 4 and 5, which show the increasing importance of the suburban ring and the fringe in the

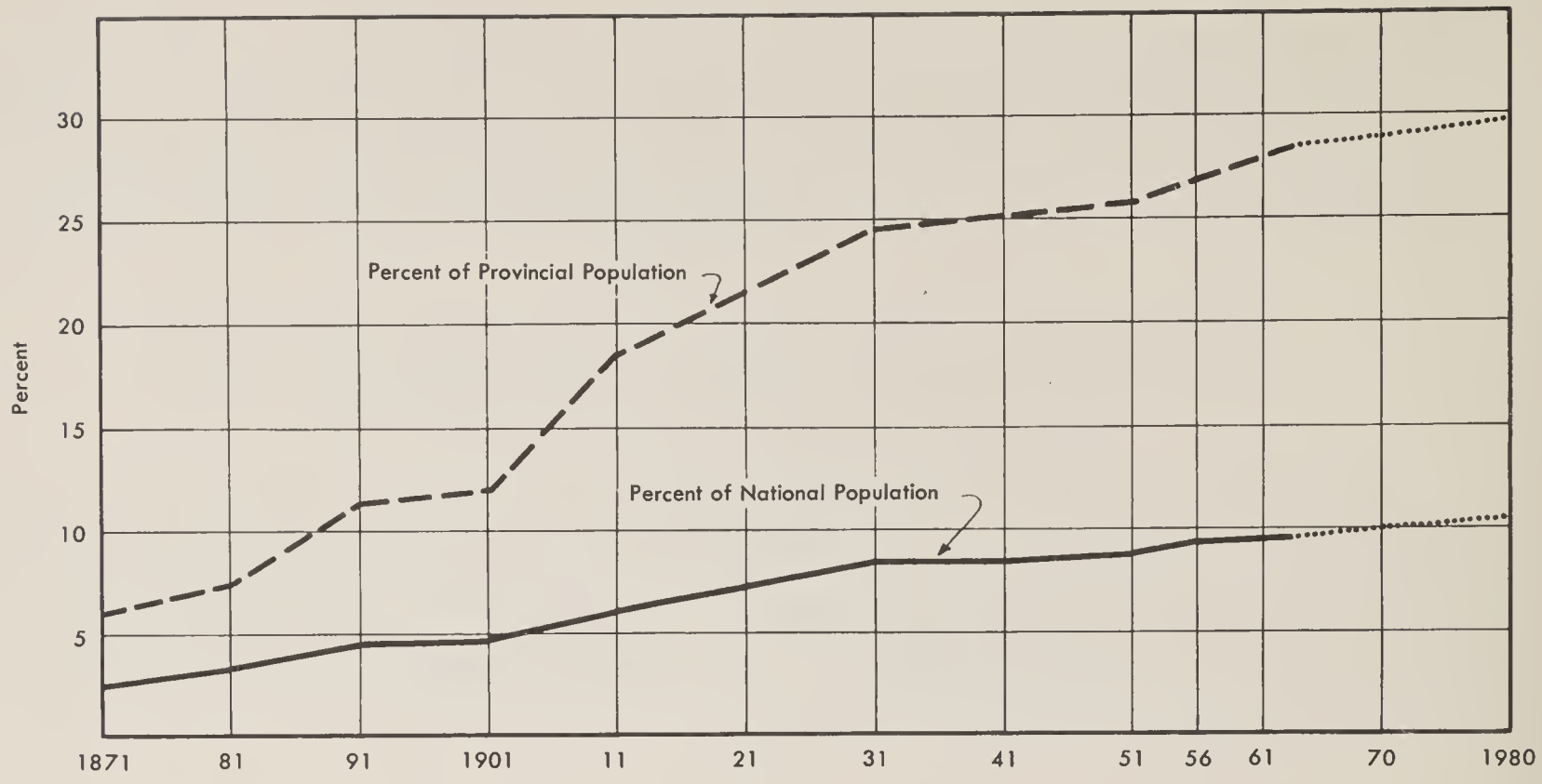


Figure 1—PLANNING AREA POPULATION AS PERCENT OF NATIONAL AND PROVINCIAL POPULATION

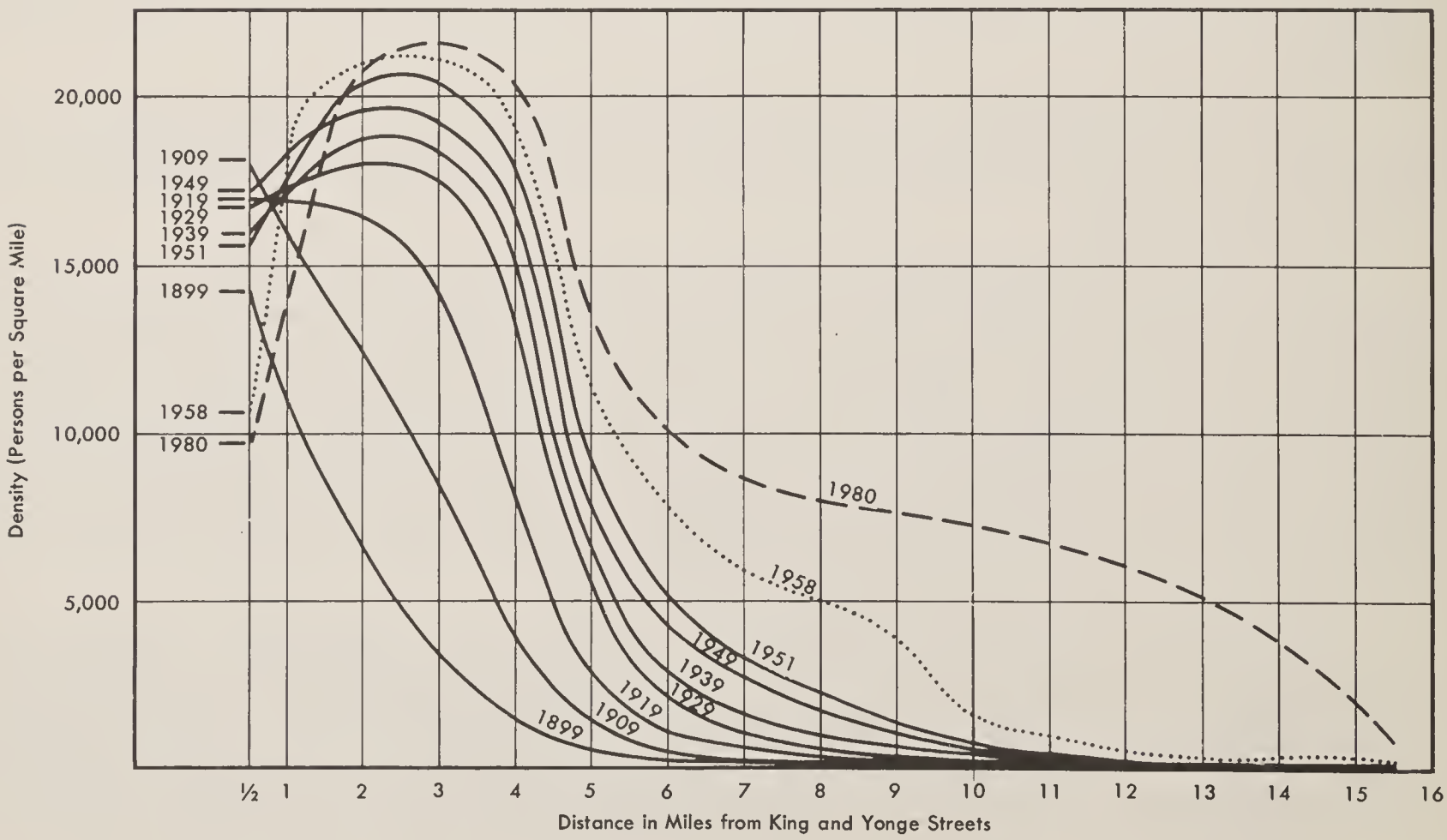
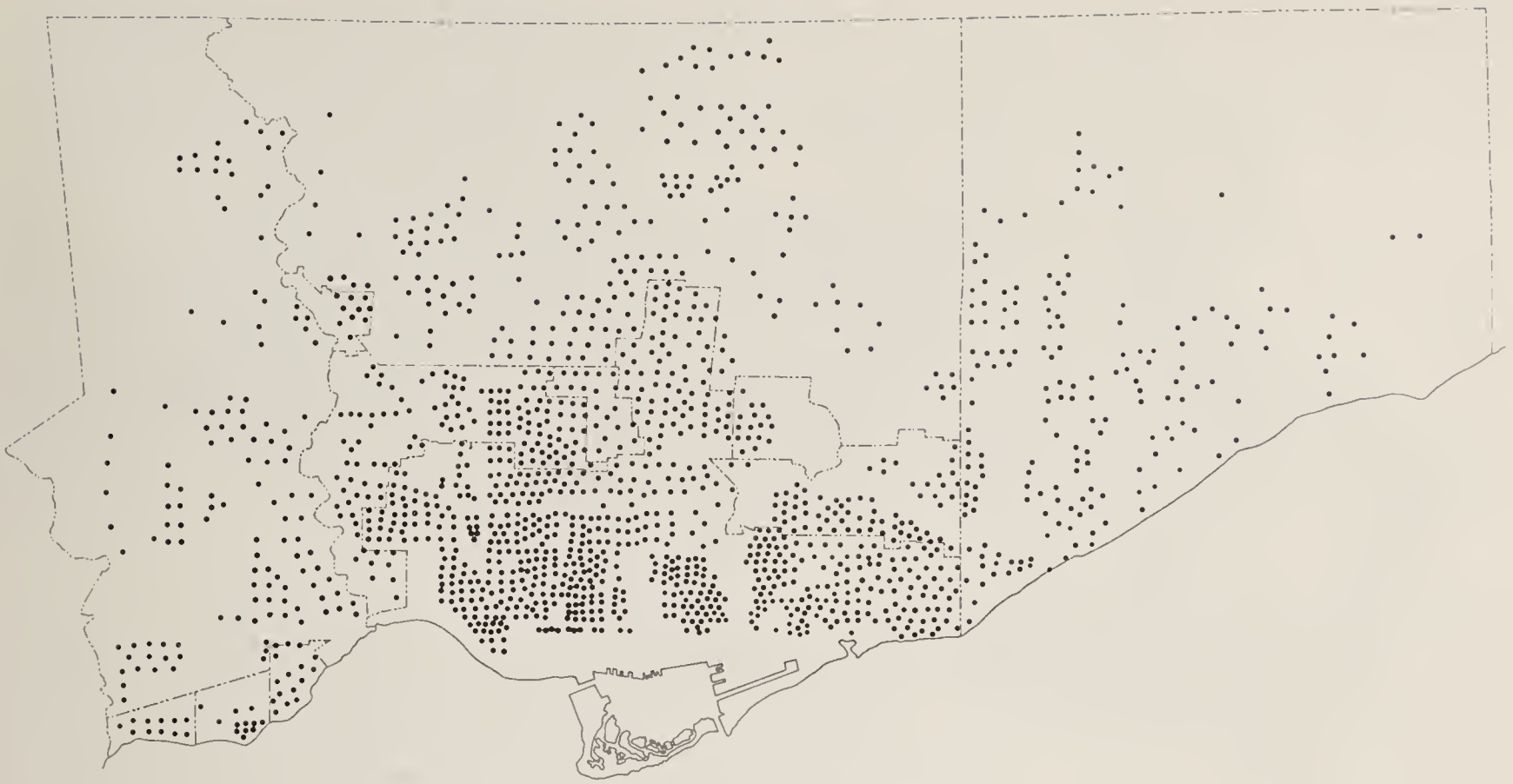


Figure 2—POPULATION DENSITY BY DISTANCE FROM DOWNTOWN



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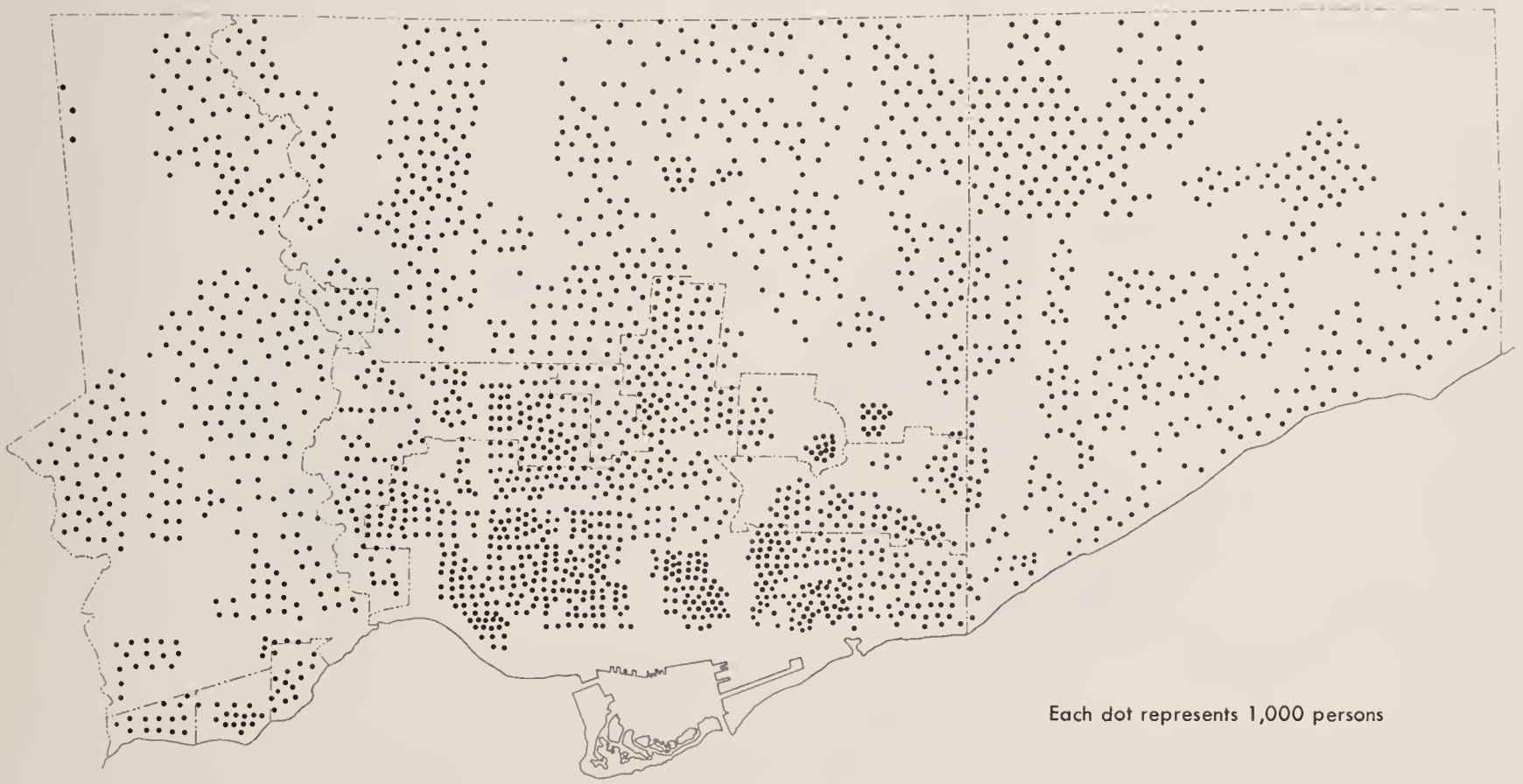


Each dot represents 1,000 persons

1980

Figure 3—POPULATION DISTRIBUTION

(Draft Official Plan 1959)

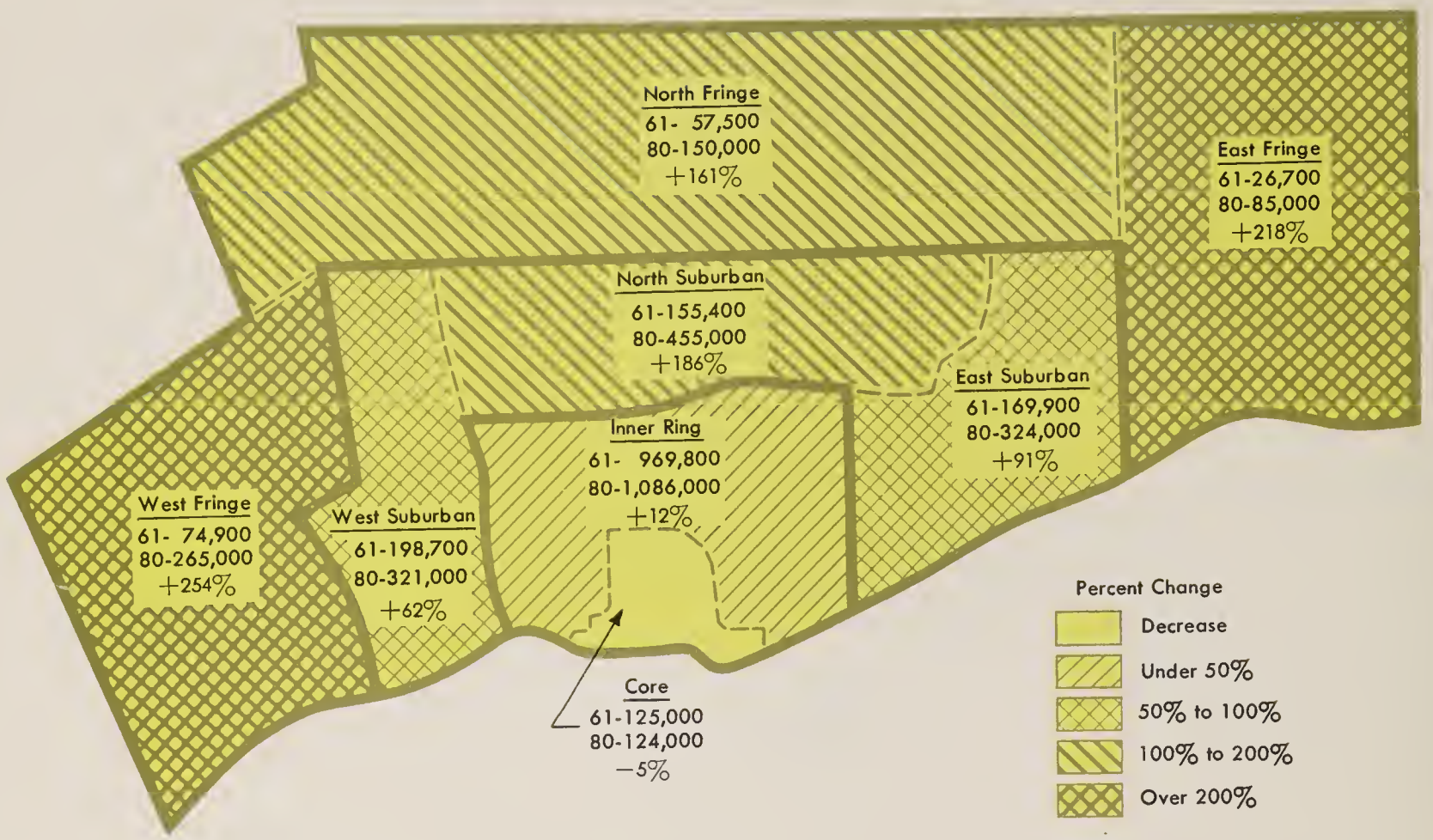


Figure 4—POPULATION CHANGE, 1961 TO 1980

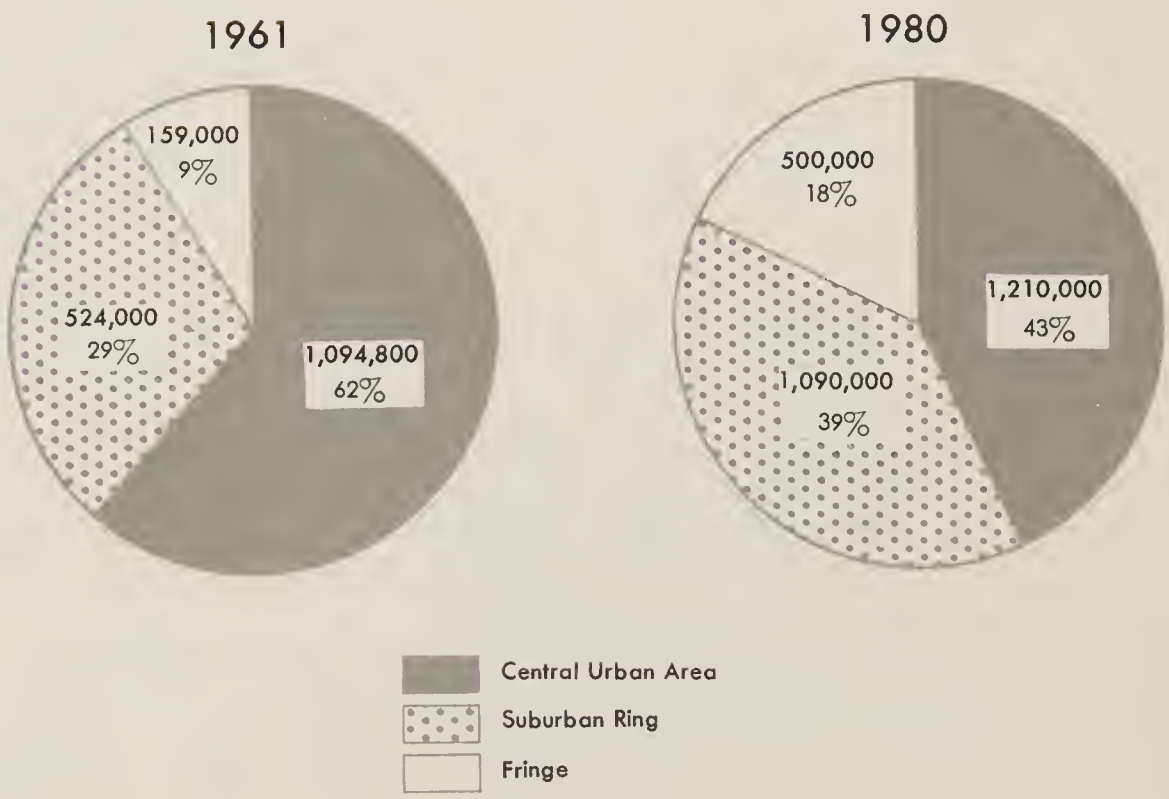


Figure 5—DISTRIBUTION OF POPULATION, 1961 AND 1980

(Draft Official Plan 1959)

overall distribution of population.* Of particular significance is the radical shift in the relative importance of the City of Toronto and the three large suburban Townships (Scarborough, North York and Etobicoke); the City, with 38% of the Planning Area population in 1961, will have less than 25% of the total population in 1980, while the three Townships, with 36% of the 1961 population, are expected to contain about 46% of the total population in 1980.

The density of settlement has considerable impact on the use and hence the planning of transportation facilities. The most significant influence of density rests in the crucial choice of travel mode as between public and private transportation, where it has been conclusively established that as density increases so does the utilization of public transit. Higher density areas tend generally to produce a greater concentration of transit users, both because of the actual number of persons served and because of the generally lower incomes to be found in such areas. This greater concentration of transit riders makes possible the provision of better transit service which in turn stimulates the usage of the transit facilities. This self-perpetuating relationship is a characteristic of all urban transit systems, and it is equally characteristic that public transit systems cannot provide satisfactory service where average densities fall below a reasonable level.

The Draft Official Plan recognized the need to achieve a reasonable density of development throughout the area, both to facilitate the establishment of satisfactory transit service, and also because of the importance of providing a wide cross-section of housing types in all major sections of the area. Recent construction trends, as summarized below, are now leading to a considerable increase in average residential densities in many sectors of the area. While the pronounced emphasis on apartment construction does not of itself produce the complete diversification of housing types called for in the Official Plan, the growing emphasis on the provision of various forms of multiple family accommodation is serving firmly to establish higher densities in most parts of the area.

TABLE 1—CONSTRUCTION TRENDS

	1954-1958			1959-1963		
	Total units	Apt. units	Apts. as % of total	Total units	Apt. units	Apts. as % of total
City of Toronto	16,250	15,370	85%	11,060	10,670	97%
*Inner suburbs	11,960	9,790	82%	10,820	9,990	92%
**Outer suburbs	66,100	13,610	21%	57,930	23,980	41%
Total Metropolitan Area	94,310	38,770	41%	79,810	44,640	57%

*Forest Hill, Swansea, Weston, York, East York, Leaside, Long Branch, Mimico, New Toronto
**Scarborough, Etobicoke, North York

The trend toward higher densities throughout the area is expected to continue over the period of the plan, as is shown in Figure 6. The following density pattern is projected:

TABLE 2—GROSS POPULATION DENSITY
(Persons per residential acre)

	1961	1980
Central urban area	38	40
Suburban ring	18	25
Fringe areas	9	16
Total urban area	24	25

*The sectors referred to in the charts are based on the Planning Districts established in the Draft Official Plan. The "Central Urban Area" consists of Districts 1-6, comprising generally the area bounded by the Humber River, Highway 401, and Victoria Park Avenue. The "Suburban Ring" consists of Districts 7-16, covering the remainder of Metropolitan Toronto, and the "Fringe" covers the remainder of the Planning Area, comprising Districts 17-23.

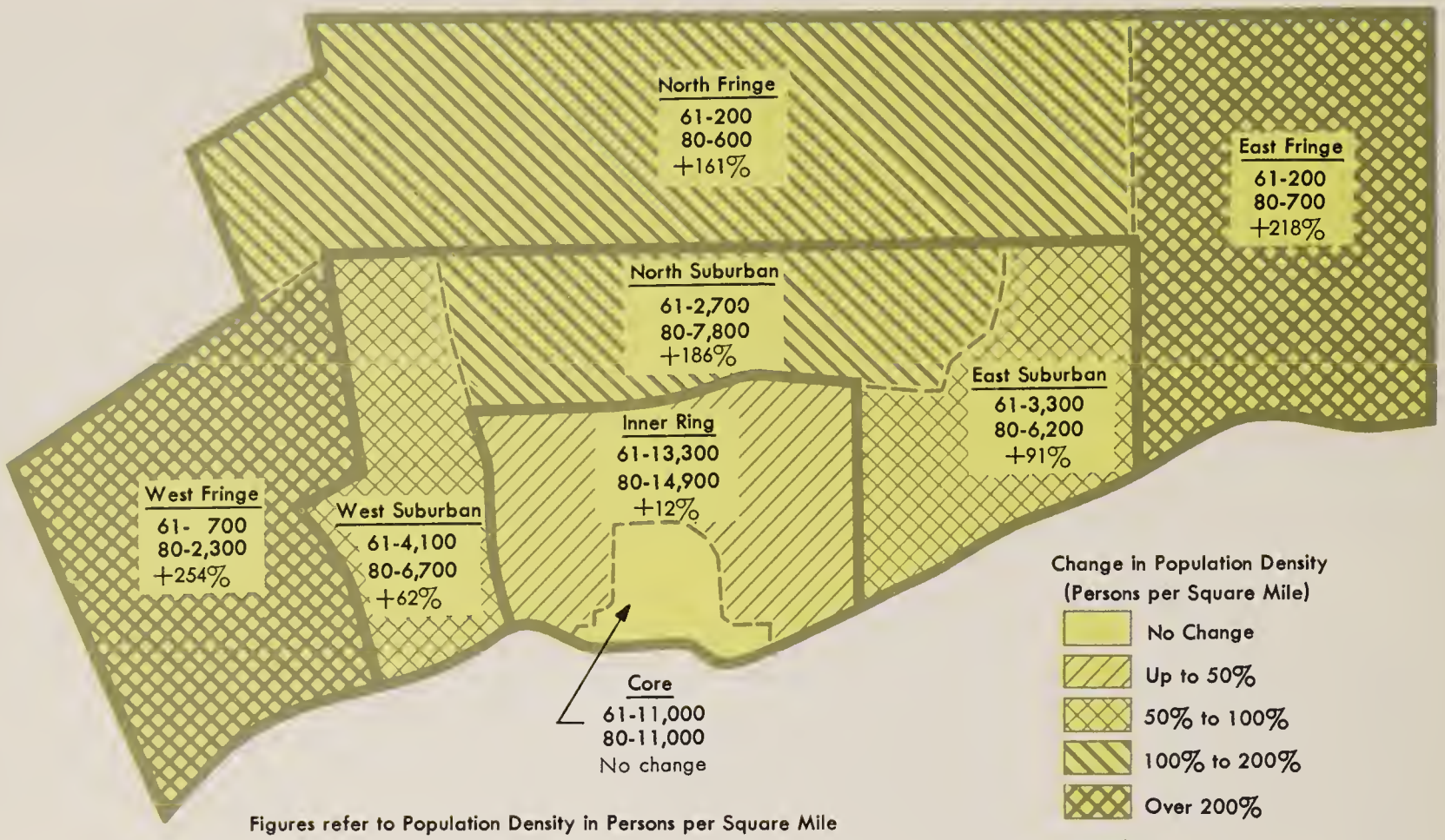


Figure 6—CHANGE IN POPULATION DENSITY, 1961 TO 1980

(Draft Official Plan 1959)

EMPLOYMENT DISTRIBUTION

Based on the anticipated population of 2,800,000 in 1980, it is estimated that total employment in the Planning Area will be about 1,215,000, an increase of some 70% over 1961. Manufacturing, which now provides about ⅓ of the area's jobs, will continue to be the principal source of employment, but is expected to account for a smaller proportion of total employment. Of increasing importance will be employment in the various regional services which support the area's role as a regional and national centre of commerce, government and education, and the local services which support the area's growing population.

The expected changes in employment composition will be reflected in many changes in the distribution of employment over the area. In determining the future land use pattern, particular attention has been paid to ensuring that employment opportunities will be distributed to facilitate maximum accessibility between residential and employment areas and to ensure maximum choice for the wide variety of job requirements of the resident population. At the same time, careful attention has been paid to the locational requirements of the various economic activities.

Of the more significant factors that have been taken into consideration which influence the form of the transportation system, the following may be noted:

1. Manufacturing and wholesale employment, both of which are largely "land-consuming" activities, will locate increasingly on suburban and fringe sites where the anticipated increase in such employment can most easily be accommodated, and where supporting facilities, such as parking and loading, can best be provided.

2. Regional services will locate largely in office structures, which do not require much land area. They will depend in large part on the proximity of related establishments, and they will require locations which are easily accessible to a scattered labour force with a high proportion of female workers. Consequently, these activities will concen-

trate primarily in the central core and in selected outlying locations at the focus of main transportation routes.

3. Local services, particularly retail trade and community facilities, serve very largely the resident population and will be generally dispersed throughout the area in accordance with the overall distribution of population. At the same time, there will be a continued concentration of retail and service employment downtown, though accounting for a smaller share of the total.

These basic trends will produce a more widespread and uniform dispersion of employment throughout the area. While the central business district will continue to represent the greatest single concentration of employment, almost all other parts of the Planning Area will receive a greater share of total employment than at present.

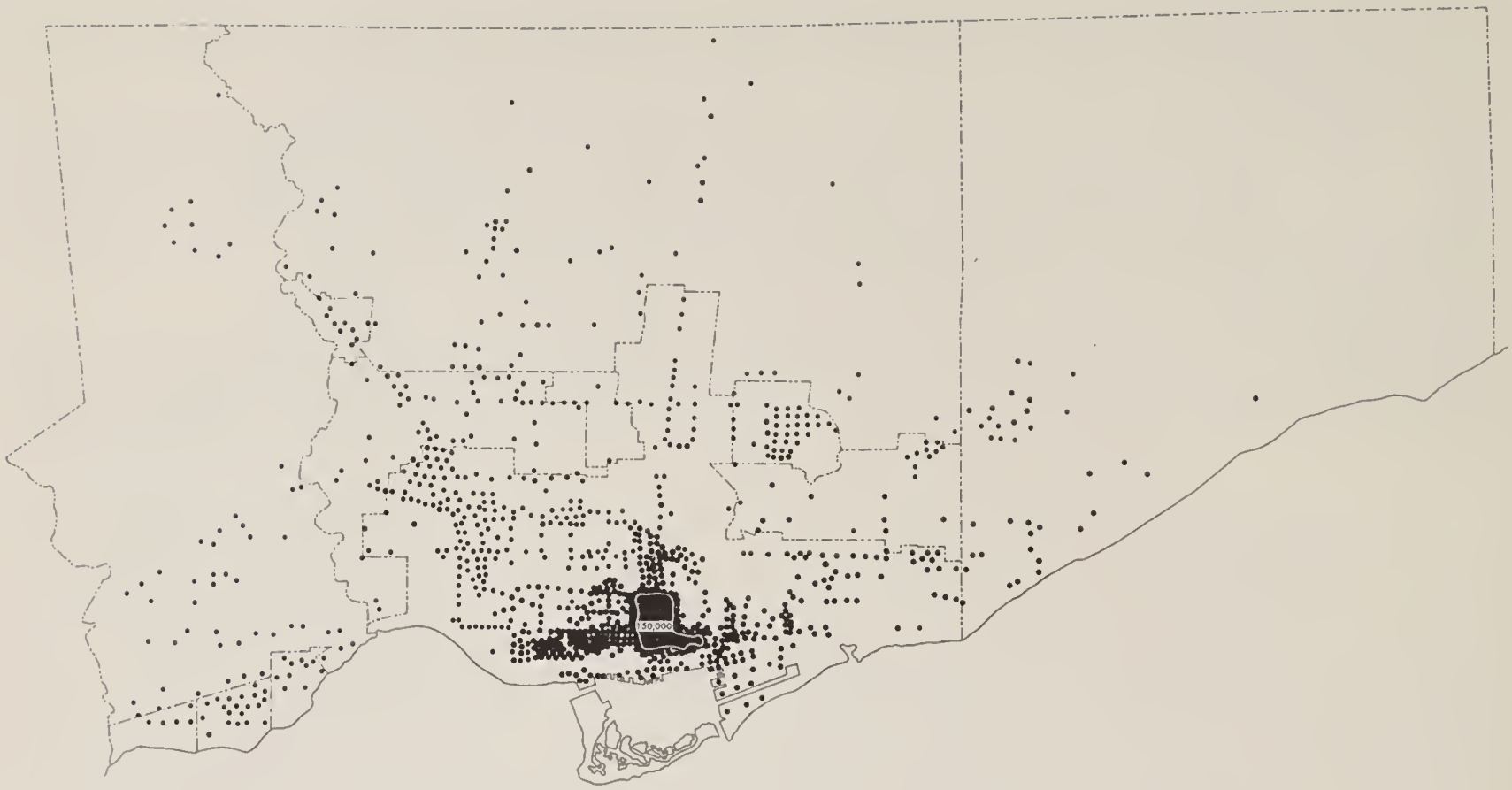
These trends are illustrated in Figure 7, which shows the increasingly even employment distribution which may be anticipated, and in Figures 8 and 9, which show the marked increase in suburban employment and the growing importance of the suburban sectors in the overall distribution of employment. As is the case with population distribution, the relative situation of the City of Toronto and the three large suburban Townships will change drastically, the City dropping from about ⅔ to little more than ⅖ of total area employment, while the three suburban Townships will increase their share of total employment from about ⅕ to ⅓. Of even greater significance, with respect to the provision of transportation facilities, is the anticipated increase of nearly 250,000 jobs in the suburban ring. The growth of almost 200% in suburban employment will be almost twice as great as the expected population growth in these sectors, indicating a noticeable shift in the direction of travel to employment. The consequences of this shift are noted elsewhere in this report.

BALANCE BETWEEN EMPLOYMENT AND POPULATION

One of the basic principles in the Draft Official Plan is that employment areas and residential areas should be located in a reasonable relationship to one another, and that for the major sectors of the Planning Area a rough sort of balance should be struck between employment and population. It is clear that the mere presence of employment opportunities in a given area does not necessarily mean that a great proportion of the employed persons residing in that area will actually work there, but the provision

TABLE 3—RATIO OF EMPLOYMENT TO POPULATION

	1961	1980
Core	250%	291%
Inner ring	28%	29%
Central Urban Area	53%	56%
West suburban sector	34%	41%
North suburban sector	19%	28%
East suburban sector	17%	34%
Suburban Ring	24%	33%
West fringe sector	27%	38%
North fringe sector	13%	27%
East fringe sector	15%	35%
Fringe	20%	34%
Total Planning Area	42%	43%



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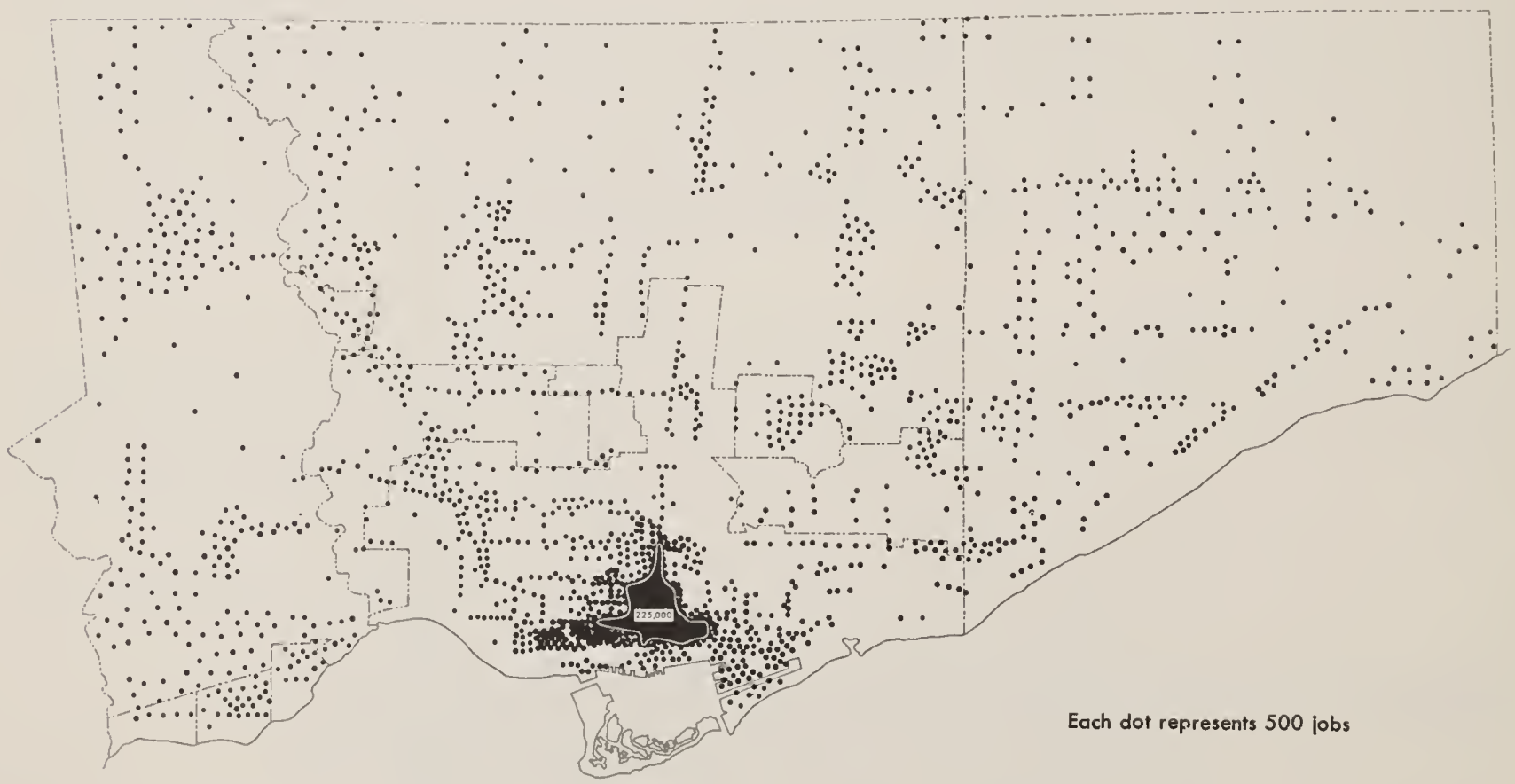

1980

Figure 7—EMPLOYMENT DISTRIBUTION

(Draft Official Plan 1959)

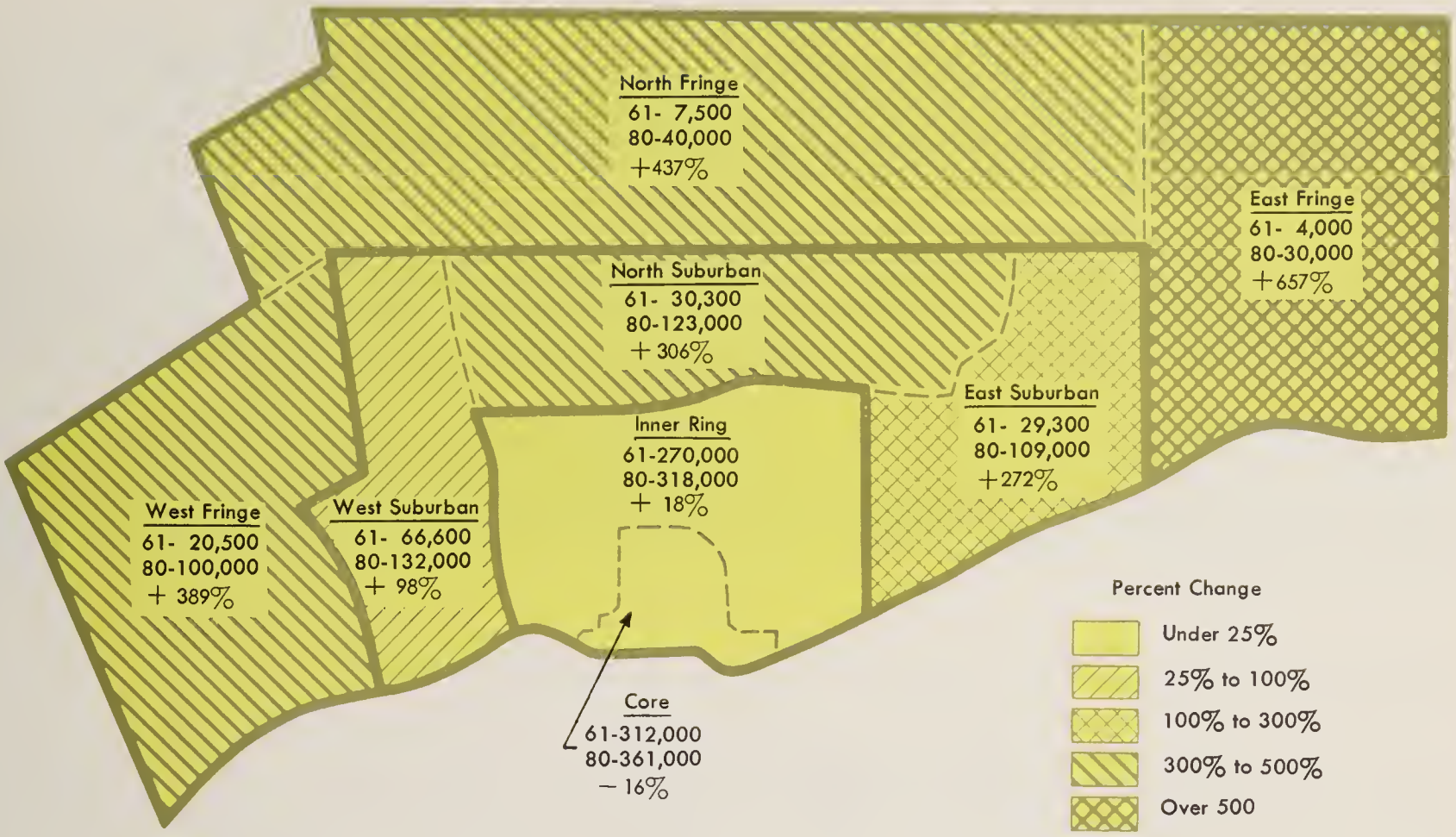

Figure 8—EMPLOYMENT CHANGE, 1961 TO 1980

(Draft Official Plan 1959)

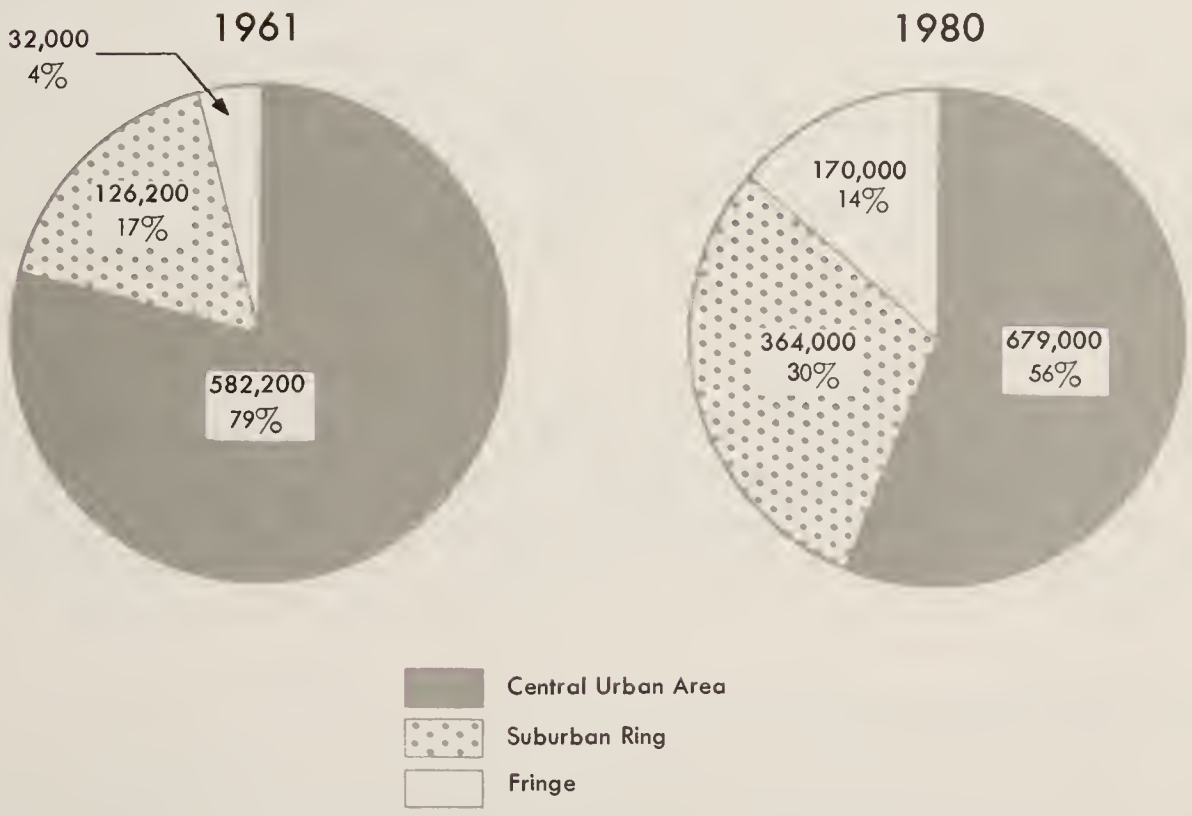

Figure 9—DISTRIBUTION OF EMPLOYMENT, 1961 AND 1980

(Draft Official Plan 1959)

of a reasonable balance between employment and population will clearly affect the need for transportation facilities and may also affect, in varying degree, the financial status of the individual municipalities. It is only when a geographic balance is struck between population and employment that there is any prospect of providing a reasonable choice of employment opportunities for the metropolitan population, with its diverse array of skills and its highly mobile labour force.

For the Planning Area as a whole, employment is expected to run to about 45% of the total population. For major sectors of the area, a rough balance is to be found in a range between 30% and 60%. Below this range, for any large area, it may be considered that employment opportunities are deficient; above this range, that not enough housing is being provided relative to industry and commerce.

Such a balance cannot, of course, be expected in small sections of the area, or in the major employment concentration in the core. As shown in Table 3, the development plan envisages a substantial improvement in the employment/population balance in most sectors of the Planning Area, particularly the suburban and fringe areas in which employment is presently deficient. This anticipated trend, if it actually materializes, will undoubtedly exert a great influence on the transportation requirements of the area.

DEVELOPMENT PATTERN

The projected development pattern for the area is shown on Figure 10. Development is to proceed in the form of a broad urban ribbon, generally limited in depth to the effective range of lake-oriented water and sewage disposal services, with a central extension to the north to accommodate existing partly-urbanized areas. This urban ribbon, though most intensely developed in the Toronto area, is actually part of a much broader development pattern which extends from Oshawa on the east to the Hamilton area on the west and is based in large part on the provision of a number of high-capacity facilities for rapid movement by road and rail, generally parallel to Lake Ontario.

The urban area is to be developed as a relatively compact grouping, with intense uses concentrating in the central core and at selected locations throughout the area in conformity with the basic transportation pattern. Residential and employment areas are to be provided in balanced proportions in all sectors of the urban area. The southern boundary, Lake Ontario, is to be developed as a park strip to the greatest practical extent, while also continuing to provide essential harbour facilities and major industrial concentrations. The urban area will be intersected at frequent intervals by broad park strips following the major river valleys, which will be developed for a variety of active and passive recreational uses. To the north will be a substantially rural area, devoted largely to agriculture but also containing a number of independent villages and non-intensive urban uses, such as golf courses, cemeteries, airports, institutions and low-density estate development. With completion of the planned transportation system, ready access will be provided both to the waterfront and river valley recreational areas and to the large open areas to the north, while at the same time the projected expressway network will connect with the inter-city Provincial highway system.

The proposed development pattern represents the product of historical trends and geographic factors, modified as necessary to produce the most suitable balance among population, employment and transportation. The proposed urban area will be large enough to accommodate the anticipated development for a period of perhaps 25 to 30 years. The development plan allows for the provision of required urban services at suitable specifications in accordance with the projected distribution of population. And it will fit well into the probable course of development in the larger region surrounding the Metropolitan Toronto Planning Area.

DEMAND FOR TRANSPORTATION FACILITIES

At present about 3½ million individual trips, covering over 15 million miles, are made on an average weekday in the Metropolitan Planning Area. Of these, about ⅓.are made by public transit and the balance by automobile. This ratio has been declining steadily for many years; as recently as 1956, about ⅔ of all trips were by transit. In 1980, assuming that the various transportation facilities proposed in this plan are carried out, and assuming the adoption and continuance of public policies supporting the operation of the public transit system, it is expected that the ratio will be maintained near the present level.

The demand for transportation in the metropolitan area has many components. First in magnitude, comprising ⅗ of all person trips, is the journey to work. Trips for social or recreational purposes comprise about 15% of all trips, shopping trips about 10%, and all other trips, including business travel, the remaining 15%. It is clear that provision of adequate transportation facilities to handle the journey to work constitutes the major demand on the transportation system, and it is to this end that the present studies and plans have been directed. This does not discount the need to provide adequate facilities for the many other trips carried out during the average day. These are obviously important and should be provided for; however, with the possible exception of the traffic demands of major recreational facilities, which can easily be identified, it is evident that adequate provision for the journey to work will almost certainly provide satisfactory facilities for the many varieties of off-peak travel.

The importance of the peak-hour journey to work underlines the crucial significance of public transit in the overall transportation system. The distribution of trips between public and private transportation is summarized in Table 4, from which it may be seen that in 1956 public transit carried better than ⅖ of all work trips, and that such trips constituted about ⅔ of all the trips carried by the public transit system.

TABLE 4—DISTRIBUTION OF PERSON TRIPS IN 1956

	Public Transit	Automobile	Total Trips	Percent by Transit
Work trips	66%	57%	60%	42%
Social and recreation	10%	19%	16%	25%
Shopping	8%	11%	10%	33%
Other trips	16%	13%	14%	43%
Total Trips	100%	100%	100%	39%

While the relative importance of transit has declined since 1956, when these figures were obtained, the general distribution of the various kinds of trips has remained about the same. On an overall basis, as already noted, the public transit system today carries about ⅓ of all trips.

Because they largely serve the journey to work, transit trips are concentrated to a greater extent than auto trips in the two daily peak hours. This may be seen in Figure 11, which shows the much greater emphasis in transit movements on the morning and afternoon rush hour, which together account for about 28% of all transit trips, as against 19% of automobile trips during the same periods. During these peak hours, the public transit system handles nearly ⅖ of all trips, compared to about 30% during the rest of the day. In the most critical sector, the rush hour trip into and out of the central business district, the public transit system handles about 70% of all trips, a ratio which has been maintained for the past 30 or so years.

Despite the continuing importance of public transit for work trips, particularly in the central area, passenger volumes have been declining for the past several years, while automobile ownership has been rising steadily. Measured in absolute terms, the number of transit passengers has declined by about 16% since 1954, from 320 million to about 270 million. Conversely, passenger car registrations have grown by about 66%, from 290,000 to 480,000. These comparative trends are particularly significant in the face of a population increase of 34% during this same period.

The relative changes in transit riding and auto ownership can best be compared on a basis which takes into account the steady growth in population. As may be seen in Figure 12, the number of annual transit rides per capita declined from 256 in 1954 to 167 in 1962, a drop of about 35%. During this same period, passenger car registrations grew from 231 to 286 per 1000 persons, an increase of 24%. Even discounting the abnormally high growth in automobile registrations during 1955 and 1956, the ratio of car ownership to population has grown at an average rate of 1.4% per year since 1956; during this same period, the ratio of transit trips to population has declined by 5.3% per year.

These comparative trends are characteristic of most large metropolitan areas in North America,

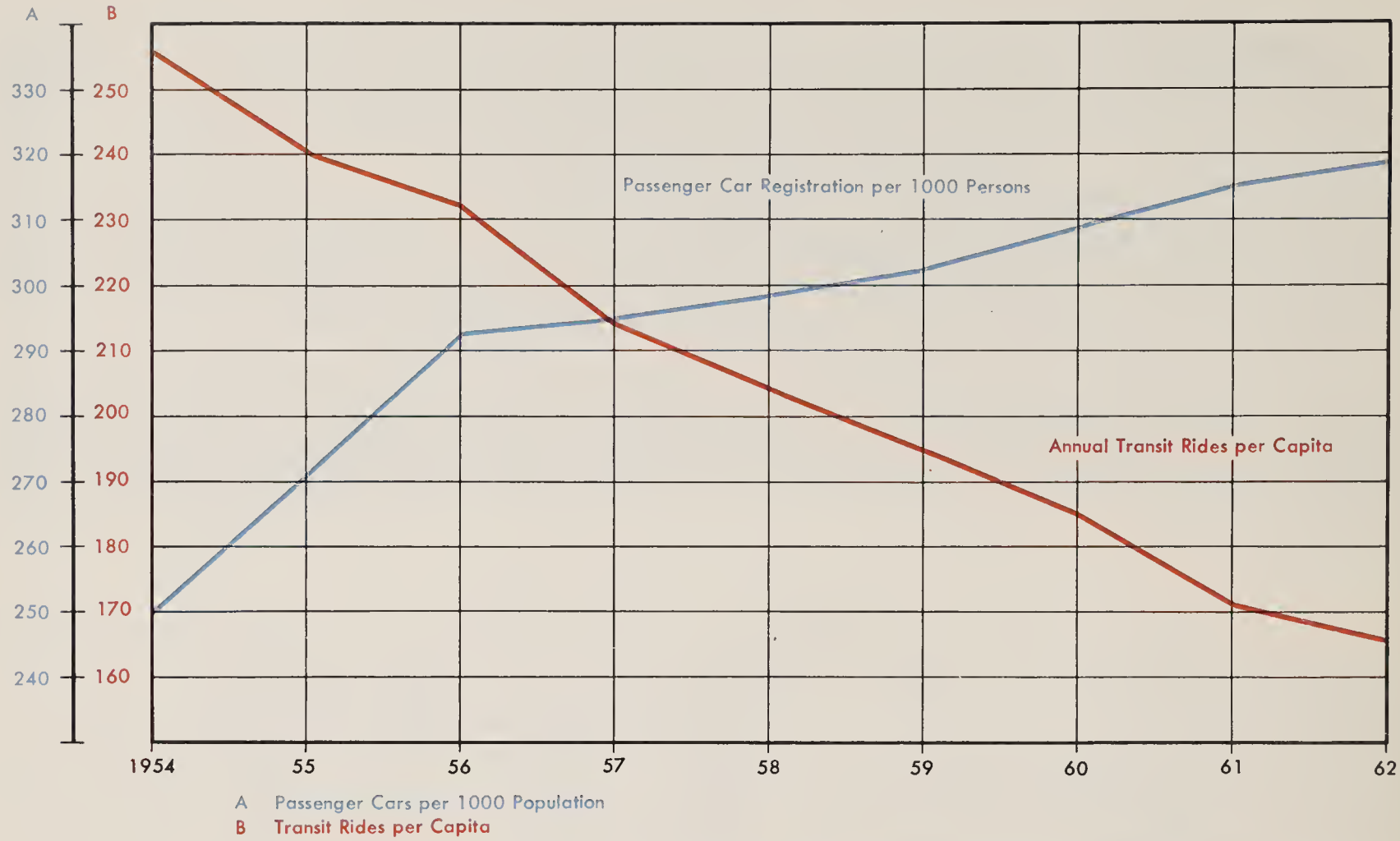

Figure 12—TRANSIT AND AUTOMOBILE TRENDS

but they have actually been less marked in Toronto than in most other areas. It was recently noted that per capita ridership is some 20% higher in Metropolitan Toronto than the average for the other large Canadian cities, and about ⅔ higher than for the major eastern and mid-western cities in the United States. Furthermore, the decline in transit volumes has been slower in Toronto than in most other Canadian and U.S. cities.*

While car ownership will continue to grow (from the present ratio of 1 passenger car per 3.5 persons to perhaps 1 car for every 2.8 persons), a substantial portion of the population will remain without private transportation and hence completely dependent on the public transit system. As the following table shows, in 1961 almost 30% of the households in Metropolitan Toronto did not have

TABLE 5—AUTOMOBILE OWNERSHIP IN METROPOLITAN TORONTO

	1951		1961		
	Percent of households with		Percent of households with		
	No car	One or more cars	No car	One car	Two or more cars
City of Toronto	57%	42%	46%	47%	7%
Inner suburbs	41%	59%	29%	52%	9%
Outer suburbs	31%	69%	11%	72%	17%
Metropolitan Toronto	49%	51%	29%	60%	11%

*"Economic Study of Bloor-Danforth Subway and Proposed Extensions," by Simpson and Curtin and Ong, Associated Consultants, September 1963.

an automobile; in the City of Toronto this ratio was more than 45%. While the proportion of families without cars in the Metropolitan Area has declined considerably from the 1951 level of nearly 50%, it may reasonably be expected that even by 1980 perhaps 15% of all Metropolitan households and 30% of all households in the City will still be without cars. Conversely, the ratio of households with 2 or more cars—now slightly more than 10%—may be expected to rise to about 25% or 30%.

By 1980 it is expected that there will be some 540,000 person trips in the Planning Area at peak hour, an increase of about 85% over the 1961 figure of 290,000. Perhaps 365,000 of these trips will be by private automobile, involving—at the current rate of car occupancy—about 265,000 vehicle trips at rush hour, or about double the number in 1961. Combined with an expected slight increase in average trip length, it is estimated that the road system will have to accommodate nearly 3 million vehicle miles, or about 150% more than in 1961. At the same time, the public transportation system is expected to handle about 50% more rush hour trips than was the case in 1961. These projections, taken together, establish the general dimensions of the transportation system which will have to be provided to support the anticipated growth and development of the area over the next 15 to 20 years.

Chapter II

THE PRELIMINARY TRANSPORTATION PLAN (1959)

BASIC CONSIDERATIONS

The general principles underlying the Preliminary Transportation Plan were detailed in the Draft Official Plan (1959). They included the following major considerations:

a. Transportation and land use

The transportation system and land use pattern are closely inter-related and must be carefully designed to complement each other. In order to minimize the time, cost and inconvenience of the journey to work, a substantial amount of industrial and other employment should be available in locations easily accessible to residents of every section of the area. At the same time, it is realized that for a variety of reasons people will prefer to avail themselves of the wide choice of employment opportunities available in other parts of the area rather than those closest to home. Therefore, the distribution of land uses and the transportation facilities between the various land uses should be so designed as to permit commuting from any section of the area to any other section. While the need for commuting should be kept to a minimum, the possibility of commuting should be at a maximum.

Transportation facilities are major land users. Their impact on land use extends far beyond the area they actually occupy and is both positive and negative. The availability of transportation stimulates development, but the nuisances and hazards generated by traffic may adversely affect the amenities of residential and other land uses.

While the type and density of land use is influenced by the type and availability of transportation facilities, the provision of these facilities is similarly influenced by land use development. Transportation facilities are established if, where and when land use produces volumes of persons and goods which require facilities for movement.

In general, industries should be located close to major transportation routes because they benefit from direct access to them and suffer less from their adverse effects than do residential areas. The choice of land for industry is also limited by the need for relatively large level sites. The range of choice for residential areas is considerably wider. They should not be excessively far from access to major traffic arteries, but sufficiently protected from noise and other undesirable effects. In particular, residential communities should not be cut up by major traffic arteries, but where possible by-passed by them.

b. External and internal traffic

The Metropolitan transportation system must recognize and sort out, to the greatest practical extent, the conflicting requirements of internal and external traffic. This has been achieved to a considerable extent for the movement of freight and passengers by rail, where inter-city and local movements are reasonably separated. For goods movement by vehicles, the establishment of some consolidated truck terminals at peripheral locations has been partially effective, but the conflict between long-distance and local truck movements still persists. Large over-the-road trailer trucks add to street congestion and, because of congestion, incur costly delays in picking up or delivering small loads within the intensely developed area.

For passenger movements by automobiles, the conflict between local and external traffic is most acute. Highway 401, originally intended as a by-pass for long-distance travel, is now used almost entirely

by vehicles moving within the metropolitan area. Many of the other arterial roads perform this dual function to a greater or lesser degree. Complete separation of roads for long-distance and shorter-distance trips is neither economically feasible nor necessary, but the system of expressways and major arteries must be so designed as to minimize undue mutual interference.

c. Goods and passenger transportation

The separation of conflicting goods and passenger movements is also desirable, but has to be balanced against the economies achieved by joint facilities. In the case of rail facilities, the establishment of new outlying classification yards by both major railroads will provide substantial relief to serious congestion on many of the passenger lines and the approaches to Union Station, and will make several existing rights-of-way available for the development of such commuter or rapid transit facilities as may be warranted.

On the roads, the competition for space between passenger cars and trucks (and, often, transit vehicles) is most acute, and extends as well to curb-loading and curb-parking, which conflict with each other as well as with moving traffic. There is no simple solution to this problem, for which many diverse approaches are required, including the designation of selected truck routes and the prohibition of truck traffic on others, the development of adequate off-street parking and loading facilities, and the enforcement of appropriate parking and loading prohibitions.

d. Private and public transportation

The volume of traffic generated between any two given areas is a function of their density; of the number of people living, working, shopping, or assembling in each area, as well as the time and cost required to travel from one area to the other. These volumes in turn indicate the mode of transportation best suited to carry them.

Where only a few people travel in a given direction during a given hour, it is not economically possible to provide public transportation. Without public transportation all person-movements dispersed in space and time have to be served by the private automobile, using the road system which also serves for truck movement and for immediate access to the adjoining properties.

At the other extreme, where thousands of people travel in a given direction during a given hour, it is most uneconomical and impractical for each of them to travel in his own car. Their needs are best served by high speed trains operating on their own right-of-way and capable of carrying large passenger volumes.

Where passenger volumes are between these two extremes, they are best handled by buses or street cars using the general road system.

Suburban development which consists principally of detached single-family houses results in densities of 5,000 to 10,000 persons per square mile. Such densities produce passenger volumes which are barely sufficient to support a bus service at the peak hours of travel and in the main direction, to and from the central city. In these areas it is practically impossible to operate public transportation at other hours or in other directions, except at a high public subsidy. This type of development, which has been made possible by the private automobile, has also served to bring the private automobile into and through the more densely developed areas, where it contributes to street congestion and competes with public transit for street space.

The solution to this problem is to be sought in two directions. First, by increasing suburban densities through mixed development which is a primary objective of the Official Plan. Second, by encouraging residents of low-density areas to park their cars at rapid transit and railroad stations and continue their trip by means of public transportation.

It would seem to be an ideal solution to extend the rapid transit lines to serve the entire Planning Area, or at least the entire Metropolitan Area. This is clearly not practicable, however. Passenger loads in the outer areas are so much lower than those in the inner areas that it would be unwarranted to extend to them frequent service by four-to-eight car trains. Moreover, the close spacing of rapid transit stations required in the inner areas lengthens the total travelling time from the outer areas to the centre

so much as to be not competitive with travel by private automobile. Therefore, the area beyond a distance of about 7 or 8 miles from the centre has to be served either by feeder buses leading to the rapid transit system, or by an entirely different system, the suburban railroad, operating less frequent and generally shorter trains, with more widely spaced stations in the outer areas and no stations in the inner area except those required for transfer to the transit system.

Where suburban railroad service cannot be established, express buses on expressways are the best means of providing public transportation from the outlying areas to the centre. Such buses can collect passengers on the suburban street system and distribute them onto the rapid transit system or directly to their downtown destinations.

All means of public transportation, especially those serving peripheral areas, have to contend with the fact that they have to maintain fixed facilities, rolling stock and personnel sufficient to serve high loads during peak hours, which are not needed during all other hours. The difficulty is compounded by the fact that peak hour movements are predominantly in one direction, inbound in the morning and outbound in the evening.

This situation would be substantially improved by decentralization of employment such as is provided for in this plan, provided employment densities in outlying areas increase to the point where they could be served efficiently and economically by public transportation.

The foregoing considerations define the role which is best performed by each mode of transportation in an integrated system:

The *private automobile* must serve all movements within low density areas, including travel to work in outlying establishments, and travel to railroad and rapid transit stations. In addition, it must serve movements in medium density areas in unusual directions and at unusual times. It also must serve movements in high density areas by persons who use their cars for business trips during the working day.

Public surface transportation is able to serve most movements in medium and high density areas, including feeder movements to rapid transit and suburban railroad stations, direct movements from medium density areas to the downtown area, and very short movements within the downtown area.

Rapid transit serves long distance movements and some medium distance movements within medium density areas, most movements from medium density areas to the downtown area, some movements from low density areas to the downtown area, and in addition, movements within the downtown area.

Suburban railroad lines primarily serve movements from the more distant low density areas to the downtown area. These may travel to the downtown area directly or by transfer to rapid transit lines.

Express buses can serve movements from the outskirts to the centre and to rapid transit stations, and to specialized points of concentration as well.

While private transportation is used for about ⅔ of all work-day person trips within the Metropolitan Area—and for more on week-ends and in the fringe—public transportation performs the most essential function of carrying people to and from work, in particular to the main concentration of employment in the central area. As already noted, over 70% of all persons entering and leaving the downtown area during the peak hours do so by means of public transportation and this proportion has been maintained over the last 30 years. This traffic could be handled by private transportation only at enormous cost in land, money and congestion.

For this reason, the maintenance of public transportation is essential for the proper functioning of a metropolitan area of close to three million population. Moreover, rail transportation on separate right-of-way, which is the backbone of the transit system, is the only means of transportation which functions efficiently under adverse weather conditions, such as a snowstorm or a heavy fog.

Ideally, it would be desirable to provide all transit routes with a separate, completely grade-separated right-of-way. However, this is not financially feasible. Only a few rapid transit trunk lines can be built and must be supplemented and fed by an extensive system of surface transportation.

The position of surface transit has been made extremely difficult by the increasing use of the private automobile, in several ways. The use of the private automobile has reduced the number of potential riders on the transit system, in particular most of those travelling in off-peak hours and on week-ends. Consequently, as noted earlier, the peaks of transit passengers are far sharper than those of automobile users. During the off-peak hours transit facilities are underused, so that it is not feasible to maintain frequent schedules on the less heavily used routes. Inadequate schedules tend to reduce the number of passengers still further.

At the same time the private automobile competes increasingly for street space with surface transit, slowing down transit services and thereby making them both more costly and less attractive to the public. It is in the public interest to assist the maintenance of transit by introducing and enforcing measures of traffic control which favor the movement of transit vehicles over that of automobiles. This is especially important on transit routes carrying high volumes of passengers.

THE PRELIMINARY TRANSPORTATION PLAN

On the basis of these general considerations, and an evaluation of the anticipated development trends detailed earlier, the Draft Official Plan proposed the establishment of an extensive network of expressways and arterial roads, together with a basic system of rapid transit facilities supplemented by a wide surface transit network. These were put together for the first time in a single comprehensive document, but the individual proposals themselves were not, by and large, new. Most of the major facilities had been proposed in one form or another prior to the establishment of the Municipality of Metropolitan Toronto in 1954; some of the proposals, in fact, date as far back as 1911. Many of the proposed facilities were already in operation or under construction, or had reached an advanced stage of approval when the plan was issued. On the other hand some of the proposals were completely new, resulting from the studies that the Metropolitan Planning Board or other agencies, such as the Department of Highways, had undertaken in the period immediately preceding the publication of the plan.

The preliminary transportation plan contained in the Draft Official Plan is shown in Figure 13. The major proposals are summarized below.

a. Rapid Transit

The following facilities were proposed:

Yonge Street subway	—Union Station to Eglinton*; Eglinton to Sheppard Avenue
University subway	—Union Station to St. George**
Bloor-Danforth subway	—Keele to Woodbine***; Keele to Royal York Woodbine to Warden Avenue
Spadina rapid transit	—St. George to Wilson Avenue
Queen Street subway	—Sunnyside to Greenwood
Greenwood subway	—Queen Street to O'Connor Drive

As may be seen on Figure 14, the plan proposed a system of rapid transit lines to connect the areas of high and medium density with the downtown area and with each other. Most of the proposed facilities, with the exception of the Spadina line, had originally been proposed in earlier reports prepared for the Toronto and York Planning Board in 1948 and subsequently adopted by the Toronto Transit Commission.

In addition to the facilities shown in the Draft Official Plan, which totalled about 37 miles, the Commission had considered the establishment of a rapid transit line on Eglinton, and extensions of proposed lines, totalling about 20 miles. It was recognized in the Draft Official Plan that these lines might be required at a future date, but it was not felt that they would be needed nor could be accommodated within the financial capabilities of the municipality over the 20-year period of the plan. It was suggested that provision should be made for the establishment of future transit lines in the median strips of certain expressways, particularly the Highway 400 Extension from Dupont Street to the Gardiner Expressway, and the Richview Expressway from Scarlett Road to Highway 27. It was noted that if these reserved rights-of-way should not be required for rail rapid transit, they could be used to accommodate reserved lanes for express buses.

*Existing, **under construction, ***approved, at time of Preliminary Plan.

Figure 13—PRELIMINARY TRANSPORTATION PLAN
(Draft Official Plan, 1959)

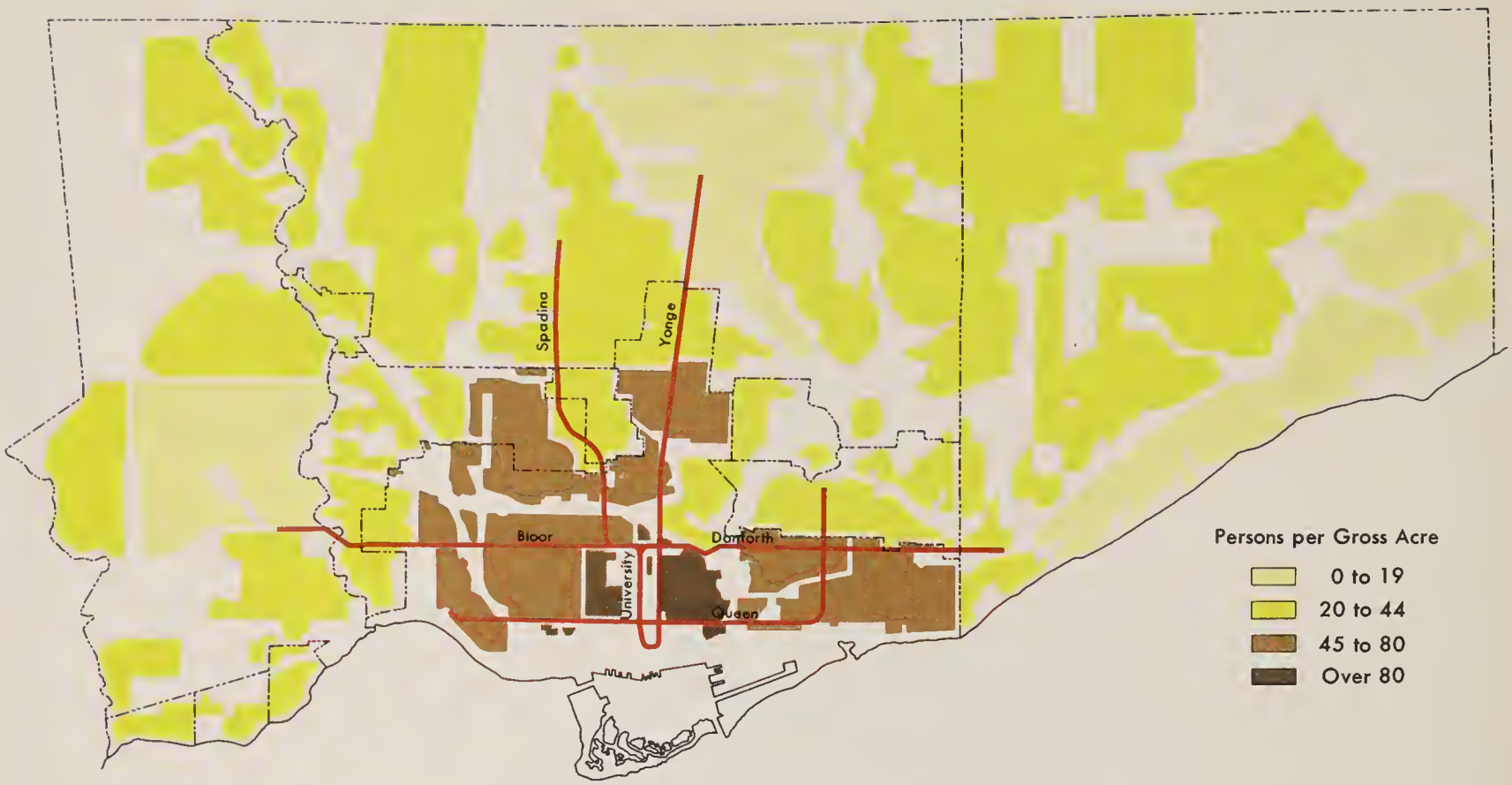

Figure 14—RESIDENTIAL DENSITY AND PROPOSED RAPID TRANSIT SYSTEM
(Draft Official Plan, 1959)

b. Commuter rail and express bus facilities

It was considered that the proposed rapid transit system, in conjunction with a network of feeder buses, would provide adequate public transportation for a distance of approximately 10 miles from the central area. Beyond this distance, it was felt that the transit system would not generally be competitive in travel time with the private automobile. These areas can effectively be served only by a form of public transportation which reduces travelling time by reducing the number of stops. Such service could be provided by suburban railroads with stations spaced about 2 miles apart in the outer areas and with very few stations in the inlying areas, primarily for transfer to the rapid transit system. While specific rail lines could not be designated for this purpose at the time, it was recommended that the various rail lines be investigated to determine their effective capacity for commuter purposes.

The plan suggested that where it was determined that suburban rail service could not be established, consideration be given to express bus services, both on expressways and on certain major arteries. These would also require more detailed examination, particularly with respect to the establishment of suitable transfer facilities between local buses and the express bus system.

c. Expressways

The following expressways were proposed in the Draft Official Plan:

Provincial Highways

Queen Elizabeth Way (Etobicoke Creek to Humber River)
Highway 401 (Whitby Township to Trafalgar Township)
Highway 400 (Eglinton to King Township)
Highway 27 (Queen Elizabeth Way to Highway 7)
Highway 407 (Northern by-pass; Highway 401 to Highway 7)
Highway 404 (Steele's Avenue to Whitchurch Township)

Highway 403 (Toronto-Hamilton Expressway; Trafalgar Township to Indian Line)

Metropolitan Expressways

Gardiner Expressway (Humber River to Highland Creek)
Don Valley Parkway (Gardiner Expressway to Steele's)
Spadina Expressway (Bloor to Highway 7)
Highway 400 Extension (Eglinton to Gardiner Expressway)
Crosstown Expressway (Highway 400 Extension to Don Valley Parkway)
Richview Expressway (Indian Line to Highway 400)

The proposed expressway system comprised radial, cross-town and circumferential routes, interconnecting with the principal Provincial highways outside the area. It was designed primarily to provide fast efficient movement between main residential and employment areas and the central city. An essential component was the inner ring surrounding the central core, which would serve to distribute expressway traffic destined for the central area and as a by-pass for the heavy through traffic which presently travels through this area. The intermediate ring, comprised of Highway 27, Highway 401, the Gardiner Expressway and the Queen Elizabeth Way, would serve similarly as a channel for through traffic movements to by-pass the main employment and housing concentrations. Of particular significance, as is shown in Figure 15, was the basic relationship between the expressway network and the planned pattern of industrial development.

As is the case with the rapid transit system, most of the proposed expressways represented projects of relatively long standing, many of which were either already in existence or under construction when the plan was issued. For example, much of the basic Provincial expressway network was already in existance at the time (Highway 401, Highway 27 and the Queen Elizabeth Way), and the essential Metropolitan projects required to complete this basic first stage expressway system (Gardiner Expressway and Don Valley Parkway) were already under construction.

Altogether a total expressway system of some 203 miles was proposed in the Draft Official Plan,

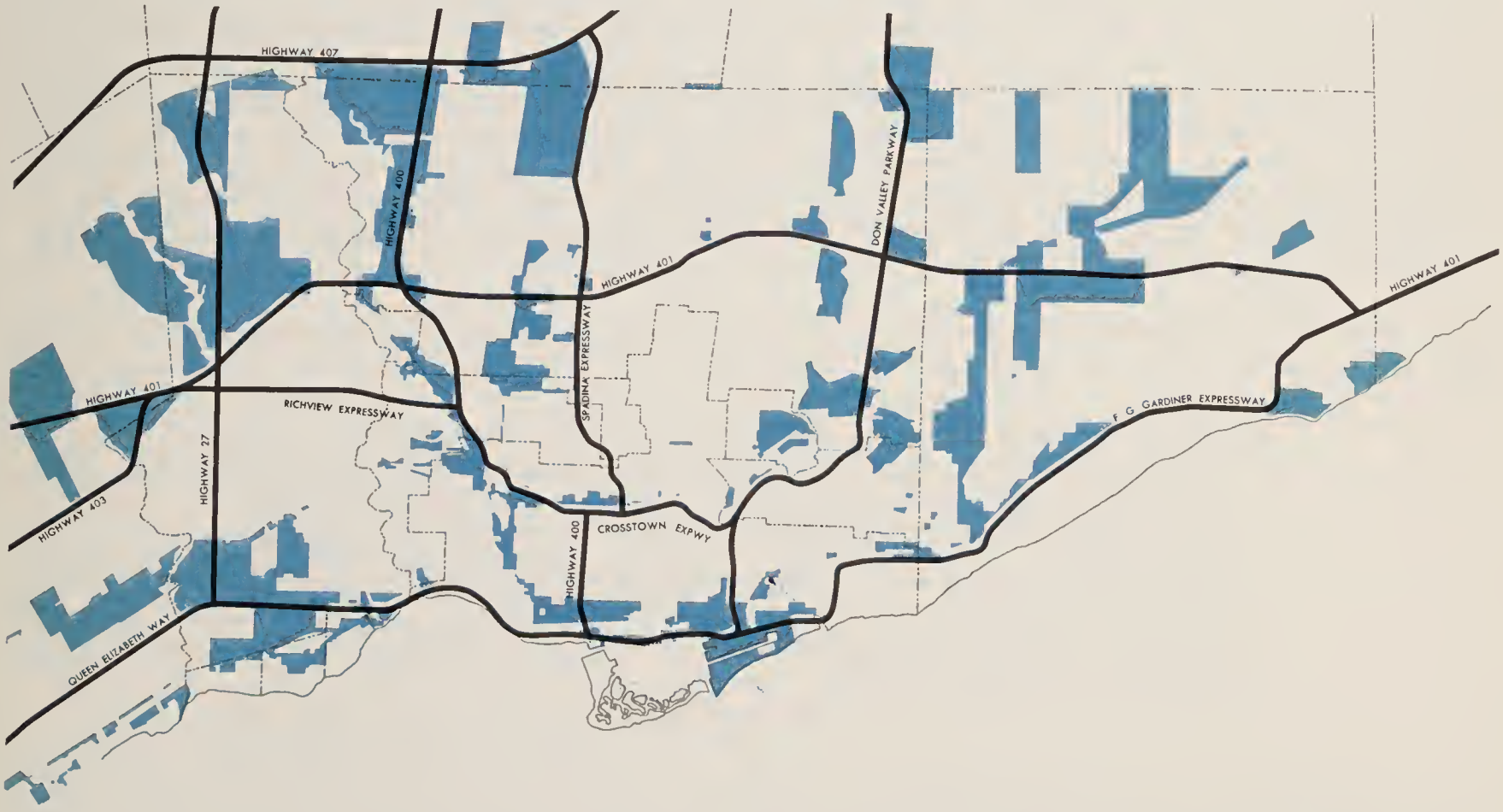

Figure 15—INDUSTRIAL AREAS AND EXPRESSWAY SYSTEM
(Draft Official Plan, 1959)

of which about 82 miles was in existence. *Just over half the network, or 103 miles, would be within Metropolitan Toronto, and of this about 55% would be under Metropolitan jurisdiction.

d. Arterial roads

The arterial road system, providing both for through traffic movement and for access into major employment, commercial, and housing areas, was coordinated with the expressway system to provide for the distribution of through traffic to collector and local streets. Continuity of routes was emphasized in order to facilitate the movement of through traffic. These roads, requiring a high capacity, were proposed to have a basic width of 4 to 6 lanes, with additional provision as required for turning movements, and a basic right-of-way width of 100 to 120 feet, except in the central area where existing development would make it difficult to provide road widths in excess of 86 feet.

An essential part of the plan was the establishment of criteria to establish the proper jurisdiction for the various arterial roads. These standards, which set the specifications under which specific roads would be assumed as Metropolitan Roads, were based largely on length, continuity, and amount of traffic carried. Based on these specifications, it was proposed that the then-existing Metropolitan Road system, covering 294 miles of arterial roads and expressways, should be enlarged by about ⅓, to 408 miles, with some 13 miles of existing Metropolitan Roads to revert to local jurisdiction. Of the proposed additions to the system, it was suggested that about 43 miles should be assumed immediately, with the remainder to be taken over the period of the plan.

NEED TO EVALUATE THE PRELIMINARY PLAN

The proposals contained in the Preliminary Transportation Plan were based on the various considerations referred to. As already noted, however, the plan was for the most part a consolidation of road and transit proposals that had been under consideration by various agencies prior to the formation of the Municipality of Metropolitan Toronto in 1954. The location of the proposed radial expressways was largely determined by the availability of relatively inexpensive rights-of-way linking the distant suburban developments with the high employment area of the central city. The rapid transit system was also designed to improve suburban accessibility, but was based in large part on the Toronto Transit Commission's expressed policy of replacing high volume streetcar lines with underground subways.

With the development of the Traffic Prediction Model it became possible, for the first time, to evaluate simultaneously a comprehensive transportation plan comprising both road and transit networks. The study procedure was used to determine if the individual facilities included in the plan are adequate in relation to the objectives of the plan and in relation to the predicted traffic demand. The study results have also been used to provide data for the design of the major facilities and, in particular, to evaluate a number of proposals difficult to assess by previously used methods.

In general, four basic issues required consideration in the evaluation of the 20-year transportation plan:

1. The shortcomings or suitability of the Preliminary Transportation Plan.
2. The probable effect which changes in certain critical factors, such as speed, time and cost of travel might have on the utilization of the transportation system.
3. The arrangement of transportation facilities (road, rail, transit) to establish a "balanced" transportation system on the basis of the presently recognized travel motivation and behaviour characteristics. In conjunction with this, to determine the impact of new or improved facilities on the total transportation system and the area most directly affected by the given facilities.
4. As a result of the above studies, the development of a revised transportation plan.

To examine these issues, four groups of studies were carried out, which were known as the Spadina, Variable, Concept and Plan studies. For ease of reference the group studies have been identified by the letters A, B, C and D respectively, with numbers used to identify the individual plans comprising each group.

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*Existing expressway mileage now totals about 93 miles.

A. The "Spadina" study group, comprising 5 basic plans, was established for the purpose of studying the combined Spadina expressway-rapid transit facility, an expressway only, or a rapid transit line only. Since the transportation system assumed was that described in the Draft Official Plan, the study results were also used to evaluate several other aspects of the Plan.

B. The "Variable" study group was undertaken to determine the significance of basic operational and cost factors on the use of transportation facilities. These factors included the effects of varying transit fares, transit speed, level of service and also vehicle operating cost, including parking charges. The results were then applied in evaluating further studies of alternative transportation systems.

C. The purpose of the "Concept" group, comprising six plan variations, was to establish the extreme limits within which a "balanced" transportation system could be designed. The procedure involved a comparison of plans which were predominantly road-oriented with plans which included an increasing amount of transit facilities with only minimal expressway facilities.

D. The "Plan" group of studies was undertaken to evaluate the recommended 20-year plan, developed as a result of the previous studies.

A description of the characteristics of each plan studied is given in Appendix B.

The primary concern in evaluating the preliminary plan and the several variations tested was to determine the extent to which they met the basic objectives of a suitable metropolitan transportation system, as outlined in Chapter III. However, in the course of the studies it became evident that several aspects of the preliminary transportation plan required detailed evaluation in order to determine whether the facilities in question should be retained in the final recommended plan. It was also apparent that certain facilities which had not been included in the original proposal warranted serious consideration. The principal matters which required specific consideration concerned the expressway and rapid transit system. The former included the question of the need for the Crosstown Expressway; the route of the Highway 400 Extension; the adequacy of existing roads to handle traffic at the terminal ends of the Spadina Expressway; and the general question of interchange locations, particularly on Highway 401, the Queen Elizabeth Way and the eastern end of the Gardiner Expressway.

Concerning rapid transit, the main questions concerned the need to extend the Bloor-Danforth subway from its original terminal locations; the relation between the Spadina Rapid Transit line and the Yonge subway extension; the need for the Queen-Greenwood subway; and the use of express buses to supplement the rapid transit system.

The main questions concerning the arterial road system centred on the need for some of the new roads or road extensions proposed in the preliminary plan, and the need for some roads which had not been included originally.

During the course of the study a number of proposals included in the preliminary plan or resulting from the transportation study itself, were adopted by the Metropolitan Council or Planning Board, or by the Department of Highways. These included the following:

Spadina Expressway and rapid transit line
Eastern and western extensions of Bloor-Danforth subway
Islington and Kipling interchanges on Queen Elizabeth Way
Reconstruction of Highway 401
Reconstruction of Highway 27
Queensway extension
Wilson Avenue extension
Lawrence Avenue East extension
Islington Avenue extension
Eglinton Avenue extension

The general conclusions derived from the transportation studies, and the findings concerning the specific questions noted above, are detailed in the sections which follow. The recommended Transportation Plan is described and discussed in Chapter VII of this report.

Chapter III

OBJECTIVES OF TRANSPORTATION PLAN

The general objective of the Metropolitan transportation plan was defined as follows in the Draft Official Plan: "Simply stated, the efficient and safe movement of people and goods is the goal of public policy on all matters of transportation."

However, as the results of the transportation study show, this goal cannot be easily defined. Efficient movement certainly means fast movement, and increasing the average travelling speed represents an important criterion for evaluating alternative transportation systems. Faster speed generally means reduced travel time, and reduction of total travel time is also an important consideration.

But faster movement may also induce people to make longer trips. Comparison of the various models shows that for the identical distribution of population and land uses total travel mileage may in some cases increase by as much as 10% if improved travel facilities permit increased speed, and in some instances faster speed will not lead to a decrease but an increase in the total travelling time on the system. It is clear that when traffic moves faster people may choose residences farther from their place of work, or jobs farther from their home. The question is whether this increased mobility is "good" or "bad."

The answer can be found when one considers the extreme case of very poor facilities. In this case people would be limited in their choice of jobs to those close to their home. This would mean many "square pegs in round holes," with a corresponding loss in efficiency and productivity, not to mention personal frustration. Increased mobility, achieved through higher average travelling speed, means increased freedom of choice of jobs and homes, as well as shopping, education, and recreation.

This is certainly true when there is a fixed distribution of land use, population, and employment, as has been assumed in this study. It may become a questionable benefit, however, if improved mobility leads to greater dispersal of places of residences and jobs, which would ultimately result in increased total travel mileage and possibly even increased total travelling time. The benefit of increased freedom of choice, which improved traffic facilities can provide, can only be realized if effective land use control counteracts this tendency to "sprawl."

Without such control a vicious circle may develop. Improved traffic facilities, permitting faster travel, encourage distribution of residences and other land uses over wider and wider areas. As these areas develop, demand arises for additional traffic facilities in order to give them speedier access to other areas. Transportation and land use policies which are governed exclusively by the desire to satisfy demand inevitably create ever growing demands. They must, therefore, be guided by a reasonable concept of land use distribution. The validity of the Metropolitan transportation studies is therefore conditioned by the premise that it is possible, utilizing available planning controls, to regulate land use development according to the pattern projected in the Official Plan.

Unrestricted mobility, leading to widespread dispersion of homes and employment, is not the goal of the metropolitan transportation system. On the other hand increased mobility, reflected in longer trip lengths within the bounds of the projected land use pattern, provides the basic ease of access (for work, shopping, recreation, education and social intercourse) which is the main advantage drawing people to the metropolitan area.

Improved accessibility is therefore an important criterion in evaluating the transportation system. But reduction of total travelling time and increase of average speed may conceal great differences in

various parts of the area, and they must therefore be supplemented by criteria which relate to the geography of the area. These are, first, that the points or areas of serious congestion should be kept to a minimum; and second, that accessibility and mobility should be equalized as far as possible in all parts of the urban area, and in particular that accessibility should be improved for those sections of the area where development is particularly desirable. The central area, representing the commercial, institutional and cultural focus of the region, must be provided with maximum accessibility, and similarly accessibility should be facilitated for those sectors in which sanitary facilities oriented to Lake Ontario can most effectively be provided.

The criteria discussed so far deal with "efficiency." No factors were included in the models which would permit a direct measurement of "safety," the second goal noted in the statement quoted above. However, it is a well established fact that accidents occur less frequently on expressways than on arterial roads. In addition to their greater speed and safety, expressways divert a high proportion of long-distance and truck trips from the surface street system, and if they are built to suitable specifications (such as are laid down in the Official Plan) their traffic has less impact on adjacent land uses than does this same traffic when utilizing the surface street system. Maximizing the use of the expressway system is therefore another important consideration in the plan.

Public transit, and in particular rail transit on its own right-of-way, is even more superior with respect to safety. It is also independent of weather conditions as well as of road congestion, and consequently far more reliable than road traffic; furthermore, it does not endanger health by air pollution and does not interfere with pedestrian movement. To a lesser extent these advantages apply also to surface transit in comparison with private vehicles. Transit is also indispensable for the many persons who cannot drive a car or do not have a car at their disposal at the time of their trip. The maximum use of public transportation, and in particular rapid transit, is therefore another criterion in the evaluation of the study results.

In summary, the criteria used to evaluate the alternative transportation systems include the following:

1. Minimize total travelling time.
2. Maximize average travelling speed.
3. Minimize points of congestion.
4. Equalize accessibility within most parts of the urban area, and in particular maximize accessibility to the central area.
5. Maximize the use of public transportation, in particular rapid transit.
6. Maximize the use of expressways.

These criteria are not offered in any particular order of importance, nor can they be assigned numerical weights. They simply represent essential factors by which the *total performance* of the various alternative systems can be gauged in order to arrive at a sound basis for recommending the transportation system most suitable for this particular area.

FACTORS NOT CONSIDERED

It is perhaps equally important to note the factors which have not been taken into account in arriving at the recommended plan.

First, there has been no attempt to arrive at a "least cost" transportation system, or to evaluate the relative cost/benefit ratios of alternative systems. There have been many efforts, in other areas, to quantify the "costs" and "benefits" of various transportation proposals in terms of a monetary value for the travel time saved but these techniques are not considered relevant to the purposes of the present study, for the following reasons:

a) Time "saved" or "expended" during the journey to or from work cannot realistically be equated with time spent in gainful employment, and there is no sound basis for assigning to such time a monetary value based on average hourly wages (as is the usual procedure in such studies). Since the monetary value assigned to "time saved" is the crucial factor in weighing the "benefits" of any given proposal against its "costs," the use of an arbitrary wage value for this purpose tends to make such com-

parisons meaningless. Furthermore, there is no easy way to assign an "incremental" value to time saved; for example, there is no reason to assume that a total time "saving" of 1,000 hours which is made up of 2-minute savings to 30,000 people has the same "value" as 1,000 hours made up of 30-minute savings to 2,000 people.

b) Cost/benefit comparisons cannot take into account the true "community" costs of any given proposal or transportation system; for example, the impact which a specific expressway facility may have on community structure or amenities, or its real cost in terms of families or businesses displaced. Conversely, it is very difficult to arrive at the monetary value to the community of a public transit system which provides a reasonable level of service for persons without automobiles (or the true "cost" to the community of not having such a system).

It is not suggested that economic considerations should not play a part in arriving at decisions as to the provision of transportation facilities. It is obvious for example that if the community cannot "afford" the transportation system which best meets its needs, some adjustments will be required or additional resources secured. Nor is it suggested that individual proposals cannot usefully be analyzed on the basis of relative costs and benefits. In fact, cost considerations have played an important part in determining the general alignment or other details of the individual facilities proposed in the plan. For present purposes, however, there is little to be gained by striving for a "least cost" transportation system in which it is only possible to arrive at a very incomplete measure of either the true total costs or the true total benefits.

Secondly, there has been no effort to consider any "ideal" characteristics for the transportation system. For example, while it is possible that there is an "ideal" spacing for expressways in a typical urban area, their actual location must depend on many other factors. The distance between the Spadina Expressway and the Don Valley Parkway in North York, as an example, is about 6 miles, and it is quite possible that the "ideal" spacing, given the characteristic density of this particular area, would call for an additional expressway to be located around midway between these two facilities. Nevertheless, because of the particular circumstances it is inappropriate to impose an additional expressway through this section of the Metropolitan area. Similarly, "ideal" specifications for the proper range of the public transportation system or for a desirable commuter rail system play a small part in arriving at the actual recommendations concerning these services.

The third factor which has not been taken into consideration is the general influence which alternative transportation systems may have on the form and nature of urban development. While it is clear that transportation facilities play an important role in determining the dimensions and character of the urban area, it seems evident that the extreme mobility which has been made possible by widespread car ownership has reduced considerably the dependence on any given transportation facility. Formerly, when individual mobility was limited by the availability of suitable group transportation (or to go back further, by the effective range of horse-drawn or foot transportation) the choice of location for either residence or work-place was extremely dependent on such transportation. Today, given the moderately-adequate road system which any metropolitan community must of necessity provide, the availability of any given transportation facility is far less crucial in making this choice. In the present studies, the delineation of the development pattern has been based on a variety of factors, including the likely interaction between transportation and land use development in given areas; but many other factors, including long-term historical trends and the ability to provide essential services, have all been considered in deciding on the most reasonable form and scope of the future development area. The objective of the present studies has been to determine the most suitable transportation system to serve this development, rather than to arrive at the transportation system most likely to produce a desired form of development.

The various criteria detailed above provide a basis for the comparative evaluation of the different transportation systems studied. They do not, however, either individually or collectively, constitute the sole basis for the recommendations arising from these studies. The recommended transportation system is equally a product of the studies of community development which underly the Metropolitan Official Plan. Many of the individual facilities which are recommended have been arrived at from an examination of the data contained in these studies; but others have resulted from detailed planning considerations quite outside the scope of the present studies. The principal function of these studies, as already noted, is to provide an objective review of the transportation proposals in the light of the criteria described above.

Chapter IV

SIGNIFICANT CONCLUSIONS OF STUDIES

Perhaps the most significant result of the study is the demonstration of the relatively narrow limits within which transportation policies can influence travel behaviour, in particular the crucial choice between public and private transportation.

It was, of course, known to all serious students of the problem that the "all or nothing" solutions frequently advocated in public debate—all-out road construction without provision of transit, or concentration on transit facilities without improvement of the road system—are the products of wishful thinking or the promotion of special interests, and that any efficient transportation system must be based on a combination of both types of facilities. However, neither the extensive general literature nor any of the elaborate studies undertaken in other cities had clearly defined either the limits of the possible effects of public policy or the balancing mechanism which sets these limits.

This balancing mechanism may be described quite simply. Every measure favouring the automobile increases road use and consequently increases congestion and travelling time; this produces, as a reaction, a shift of some travellers to transit. Measures favouring transit, by relieving street congestion and facilitating higher auto speeds, produce the opposite reaction—i.e. they induce some additional auto usage.

The present studies have demonstrated that the relatively narrow limits within which public policy can operate effectively apply both to the operational factors which influence travel behaviour and to the actual transportation facilities themselves. In this chapter the findings relating to these two aspects are discussed, and the conclusions outlined which have led to the recommendations for a "balanced" transportation system.

EFFECT OF VARIATIONS IN OPERATIONAL FACTORS

The study of operational factors (Variable Studies—Group B) dealt with hypothetical variations in those aspects which exercise an influence on the choice of travel mode—the speed, frequency and cost of transit service, the operating cost of private vehicles, and the cost and supply of parking. These investigations reveal the shift in the demand for public transportation which could hypothetically be brought about by extreme changes in these factors. Application of these results makes it possible to establish upper and lower limits for the role of transit in the transportation system.

The factors investigated fall into two classes:

Favouring automobile use	Favouring transit use
Operating cost reduced 50%	Transit fares uniform 15¢
Parking charges reduced 50%	Transit fares reduced 50%
Parking capacity increased 50%	Free transit fares
Transit fares doubled	Transit speed increased 50%
	Double frequency of transit service
	Free transit fares, one-minute headways
	Parking charges increased 50%

Each of these factors was inserted separately into a specially developed "base" plan. By comparing the simulated results with those of the fixed base study the magnitude of the change induced by each

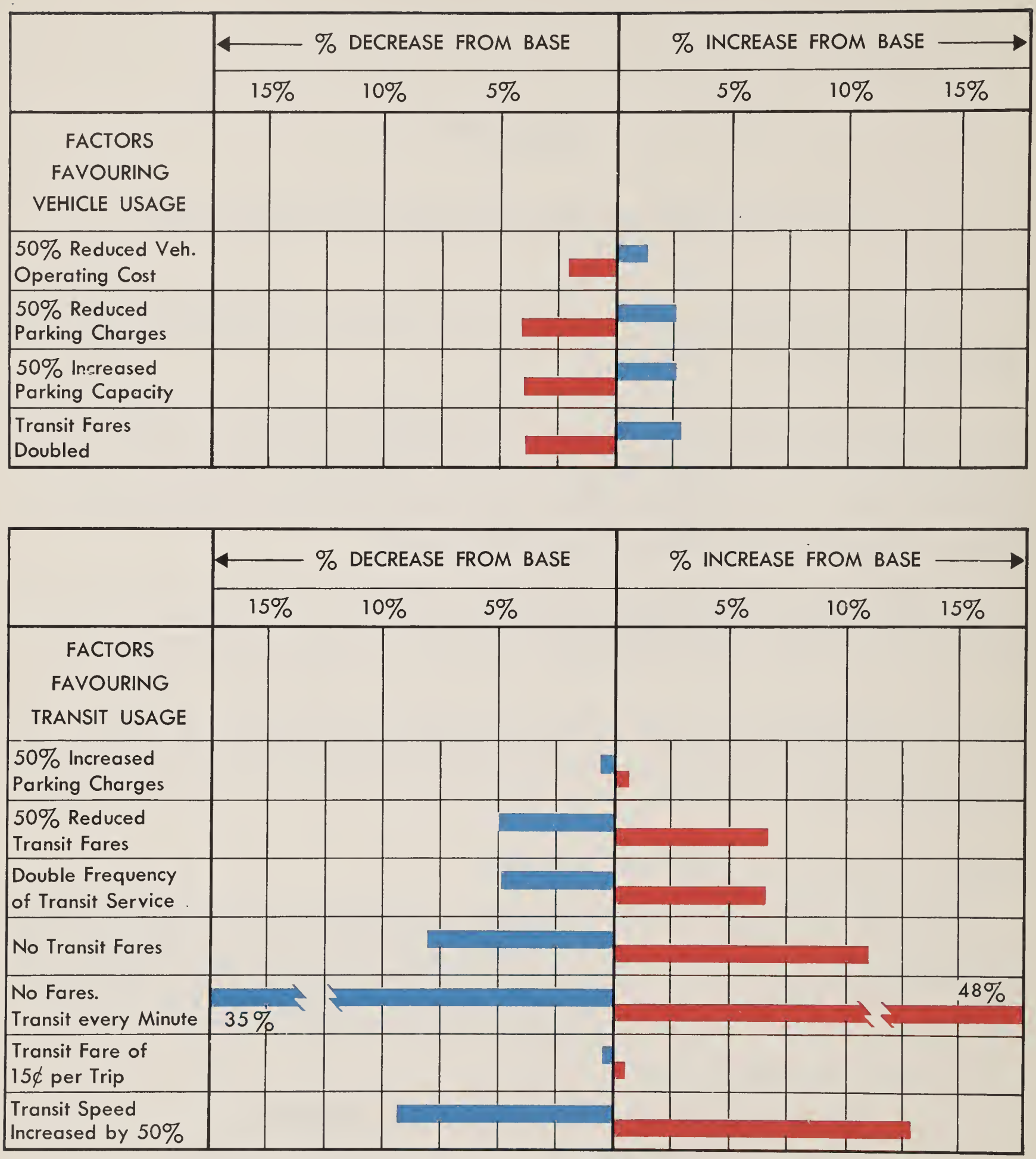


Figure 16—EFFECT OF CHANGES IN OPERATING FACTORS ON TRANSIT AND VEHICLE TRIPS

factor was determined for each of four characteristics:

a) Total travel time on the transportation system
b) Total travel miles
c) Number of trips by public transportation and by auto
d) Average length of trips by auto and transit

The results of these variations were relatively modest. For example, in the factors favouring automobile usage, the change in any of the four characteristics measured did not exceed 5% of the magnitudes established by the base study. The changes induced by improved transit service or fares generally ranged between 5% and 15% of the base magnitudes.

Some of the results of this study are illustrated in Figure 16 which shows the extent to which the individual factors would affect the number of trips made by transit and by private automobile. It may be seen that the factors favouring vehicle operation—parking fees and vehicle operating costs—would increase the total number of auto trips and reduce the total number of transit trips only nominally. The factors favouring transit usage might be expected to have a somewhat greater effect, but again not a substantial one. Even the complete elimination of transit fares would not be expected to cause a shift of more than 10% from auto to transit usage. In fact, better transit service (i.e. increased speed) can be expected to have a greater influence than fare reduction.

It is noteworthy that even the most extreme hypothesis—free transit operating at one-minute headways over an elaborate network of very closely-spaced lines—would increase transit trips by less than one-half and reduce auto trips only by one-third, and would only change the ratio of auto usage from 70% to 50% of all trips. This hypothetical situation is, of course, unachievable, but may be taken to represent the most extreme level to which changes in operating characteristics could be expected to influence travel behaviour.

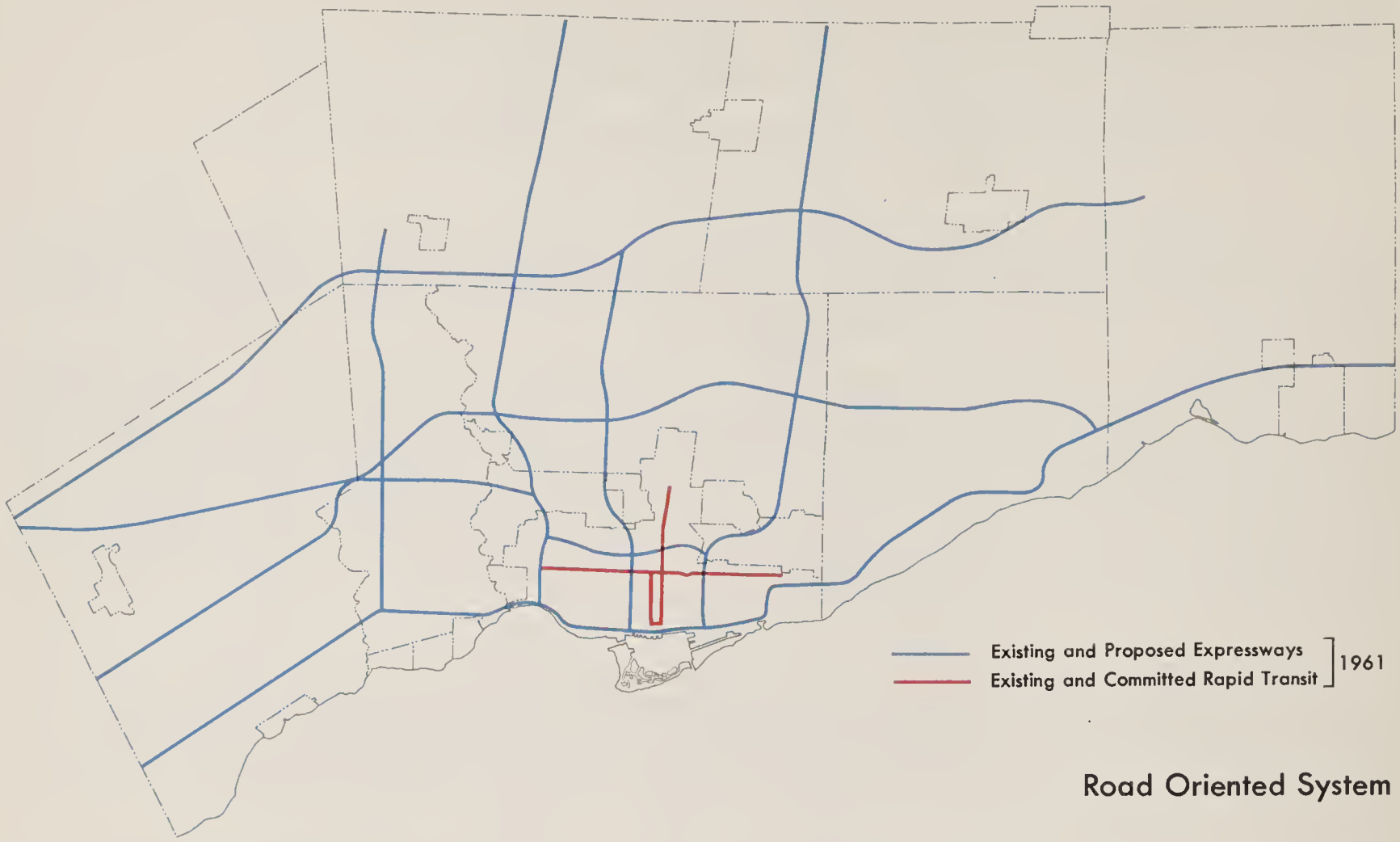
In general, it was found that the regulation of parking fees and/or parking supply can be expected to have some measureable effect on the use of public transit in areas with a high density of trip generation. Over the whole system, however, measures to improve transit service, particularly speed, would be more significant; doubling of transit speed, for example, would help to reduce total travel time on the system by almost 10%, and to reduce total travel time for vehicle trips by as much as 15%. While such an increase in transit speed is admittedly not attainable uniformly throughout the area, significant increases in transit speed might be achieved by the extensive operation of express buses and by traffic regulation and enforcement measures favouring transit vehicles. It appears quite possible, from the evidence of these studies, that such measures will provide as much benefit to the automobile driver as to the transit passenger.

EFFECT OF EXTREME TRANSPORTATION SYSTEMS

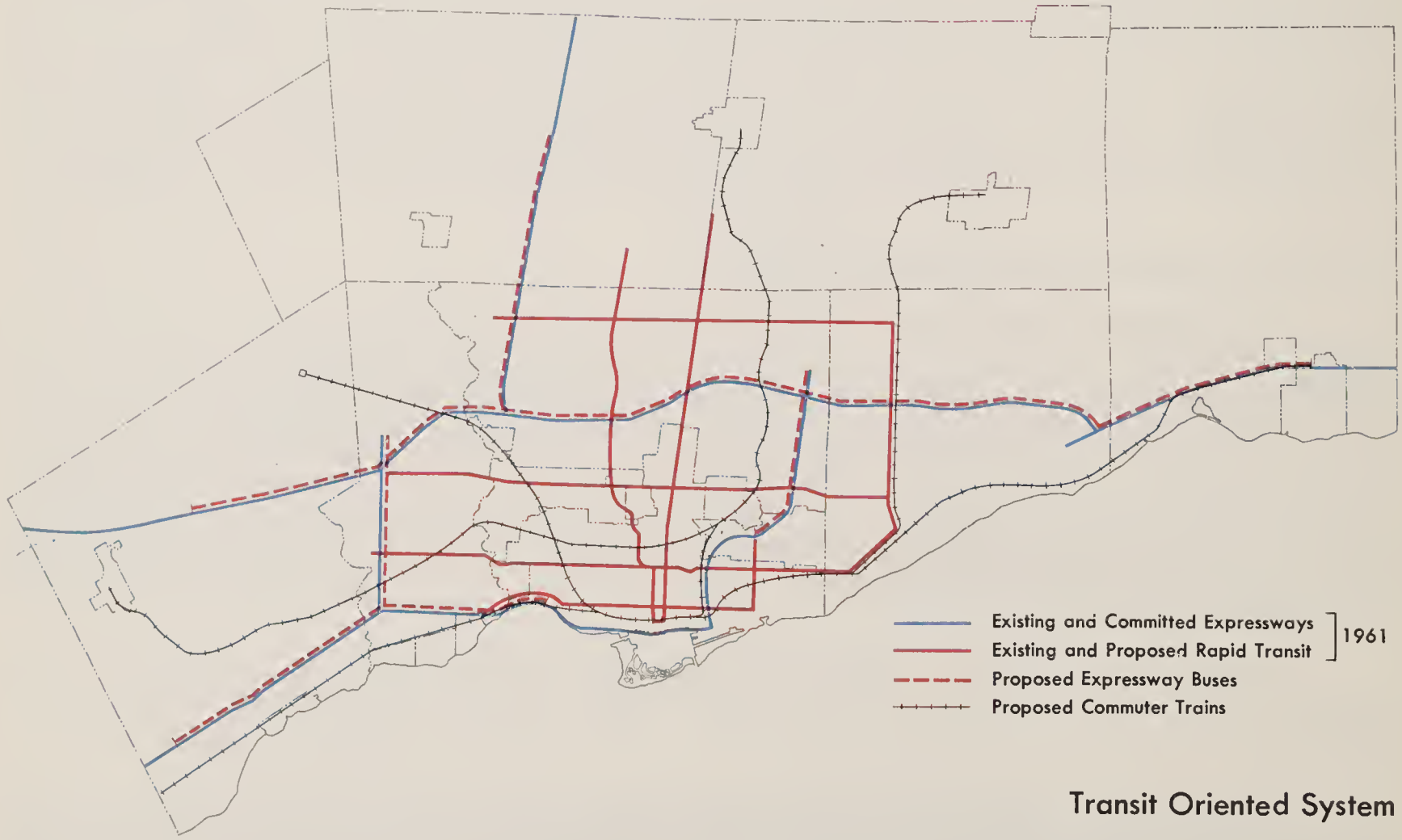
To establish the outside limits within which the Metropolitan transportation system might operate, a number of alternative transportation systems were studied and their performance analyzed. Theoretically, it would have been desirable to compare proposals for additional facilities—either road or transit—with the conditions which would prevail in 1980 if only the facilities presently in existence or under construction were available at that time. In practice, this would have been unrealistic, as there is no doubt that substantial new facilities will be provided over the next 15 or 20 years. Instead, therefore, a series of studies was undertaken (Concept Studies—Group C) in which it was assumed either that no new expressway facilities would be constructed, beyond those already committed ("transit-oriented" systems), or that no new rapid transit facilities would be constructed, other than those already underway ("road-oriented" systems).

For purposes of comparison, Plans C-3 and C-5 (which are described in Appendix B) have been taken as being most representative of the extreme systems, and these two systems are illustrated in Figure 17.

Plan C-3, the "road-oriented system," contained only the existing and committed subways (Yonge-University and Bloor-Danforth from Keele to Woodbine); no express buses or commuter rail lines; and all of the expressways proposed in the preliminary transportation plan plus an additional expressway link connecting Highway 400 to the Gardiner Expressway at Parkside Avenue. It comprised



Road Oriented System



Transit Oriented System

Figure 17—EXTREME STUDY PLANS

14 miles of rapid transit lines and 177 miles of expressways*.

Plan C-5, the "transit-oriented system," contained only the existing expressways and those under construction in 1961, amounting to a total of 81 miles; a very extensive rapid transit system totalling 88 miles, comprising extensions to all of the lines proposed in the preliminary plan and additional lines on Eglinton, Finch, and Kennedy Road; about 61 miles of expressway bus routes; and about 116 miles of commuter rail lines.

The projected performance of these two extreme transportation systems is summarized in Table 6,

TABLE 6—COMPARISON OF EXTREME TRANSPORTATION SYSTEMS

	Road-oriented System (C-3)	Transit-oriented System (C-5)	C-5 compared to C-3 (Increase or decrease)
Facilities			
1. Miles of expressway	177 miles	81 miles	−54%
2. Miles of rapid transit line	14 miles	88 miles	+529%
3. Miles of rail commuter line	—	116 miles	
4. Miles of expressway bus route	—	61 miles	
Total system performance			
5. Total travel time	281,000 hours	249,000 hours	−12%
6. Average trip length	8.9 miles	9.3 miles	+4%
7. Average trip speed	16.8 m.p.h.	19.7 m.p.h.	+17%
8. Average trip time	31.9 mins.	28.3 mins.	−12%
**9. Transit usage (% of total trips)	42%	59%	
Vehicle performance			
10. Vehicle trips	236,000	209,000	−12%
11. Vehicle miles	2,541,000 miles	1,827,000 miles	−28%
12. Average vehicle speed	22.7 m.p.h.	20.6 m.p.h.	−9%
13. Average speed on expressways	30.9 m.p.h.	23.0 m.p.h.	−25%
14. Average trip time	28.5 mins.	25.5 mins.	−11%
15. Average trip length	10.8 miles	8.7 miles	−19%
Transit performance			
16. Transit trips	220,000	310,000	+41%
17. Transit passenger miles	1,401,000 miles	2,506,000 miles	+79%
18. Rapid transit passenger miles	263,000 miles	892,000 miles	+239%
19. Average transit speed	10.5 m.p.h.	18.9 m.p.h.	+80%
20. Average trip time	36.5 mins.	25.6 mins.	−30%
21. Average trip length	6.4 miles	8.1 miles	+26%
System efficiency			
22. Vehicle miles per expressway mile	7,000	7,000	—
23. Passenger miles per rapid transit mile	19,100	10,100	−47%

*While there were 203 miles of proposed expressway in the preliminary plan, for computer purposes these expressways were measured only to the "centroids" of the outer zones in the Planning Area, resulting in a technical reduction in "computed" expressway mileage.

**See second footnote on page 39

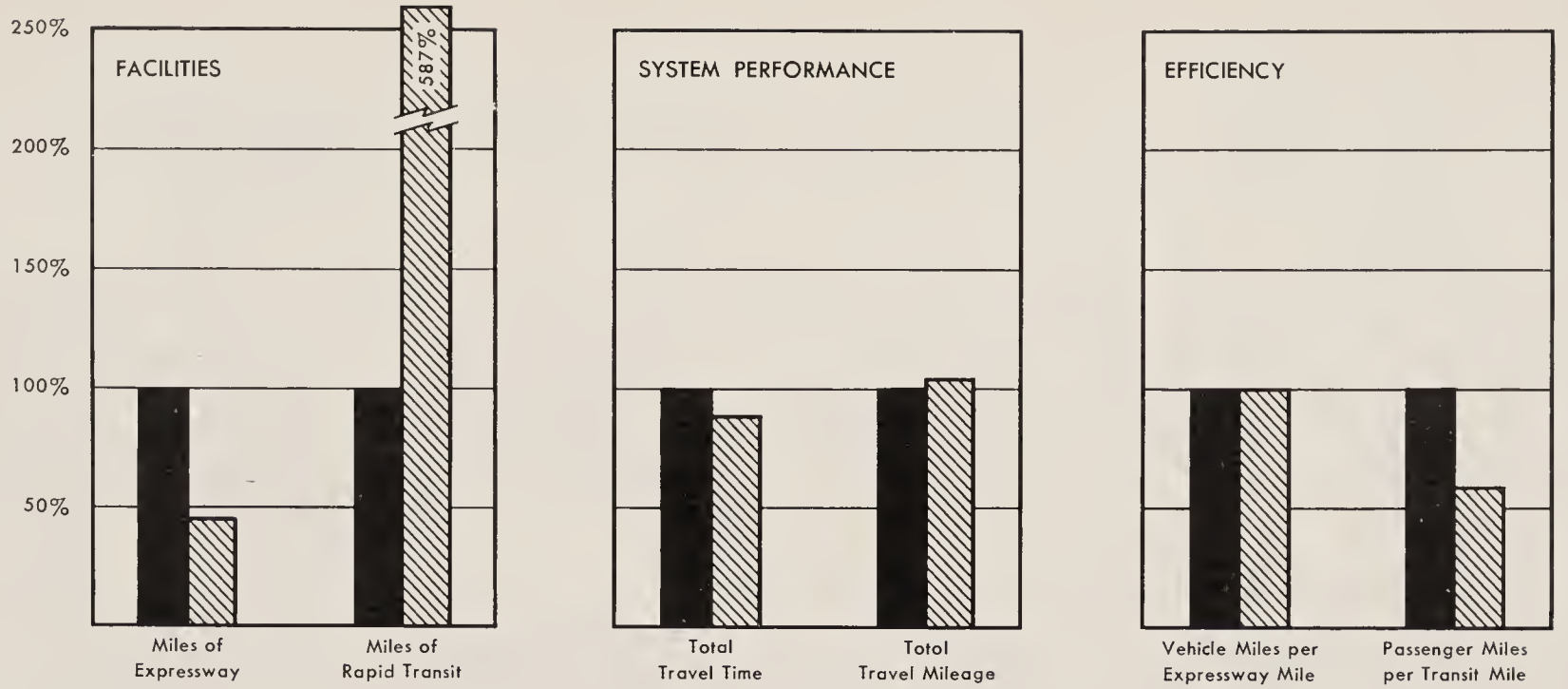


Figure 18—PERFORMANCE COMPARISON—EXTREME STUDY PLANS

and the principal results are illustrated in Figure 18.*

Examination of the study results leads to several conclusions. First, it is again evident that even the most extreme measures will have only a modest effect on actual trip behaviour. For example, a system employing extreme and unrealistic measures to encourage public transportation would reduce the vehicle load on the roads of the area by less than 30%, compared to an equally unrealistic system favouring private transportation. This would tend to occur despite the fact that the extreme transit plan assumes more than six times the mileage of subways, almost 15 times the mileage of all rail facilities (including commuter railroads), and 19 times the mileage of all major transit facilities (including expressway buses).

It is also significant that while these extensive rapid transit facilities would increase average transit speed by 80%, the number of transit trips would increase by only half as much, and the duration of the average transit trip would drop by only 30%. The main effect of providing such extensive facilities would be to facilitate longer transit trips, rather than to attract people from private to public transportation.

The converse is also true. When road facilities are kept to a minimum the main effect is to shorten the average car trip, so that even though the resultant congestion reduces car speeds by nearly 10%, the average trip takes some 3 minutes less than when road facilities are at a maximum.

One of the most significant conclusions relates to the relative efficiency of the expressway and rapid transit systems, measured in terms of average loadings (vehicle miles per expressway mile and passenger miles per rapid transit mile). It is evident that utilization of the extended rapid transit system envisaged in Plan C-5 would be only half as intensive as the minimum transit system in Plan C-3. This results from the fact that while rapid transit mileage has been increased more than six-fold, total passenger miles on the rapid transit system have increased by only 3⅓ times.

In contrast to the great reserve capacity and resulting under-utilization of subways illustrated by these figures, it is clear that expressways will always be fully loaded. This is shown by the fact that the average load on the minimum expressway system is identical with that on the maximum system, even though the latter system contains more than twice as much expressway mileage. It is also noteworthy that this reduction of expressway mileage by more than half reduces average vehicle speed on the system by only 2 miles per hour. In other words, if the road system is limited, enough people—and no more—will switch to transit to make this limited system operable even though serious congestion occurs at many points on both extreme systems.

It is evident, as illustrated on Figure 18, that the variations in vehicle performance are generally much less severe, when comparing one system with the other, than are the variations in transit performance. This again reflects the fact that the road system will always tend to operate at or near its maximum capacity, as contrasted with the great reserve capacity of an extended rapid transit system.

In the road-oriented plan transit would account for about 42% of all trips, but in the transit-oriented plan this ratio would rise to 59%.** However, as may be seen in Figure 19, the increased attraction of transit is not reflected uniformly throughout the area but is much more marked in the outer sections than in the inner zones. For example, in the outlying suburban sections where less than 20% of all trips would be made by transit (under the road-oriented system), transit usage would increase to about 40% in the transit-oriented system, and this 40% "contour" would in fact extend beyond the Metropolitan boundary in several places. The provision of extensive transit facilities might be expected to extend the 40% contour by as much as 5 or 6 miles, whereas the zone of intense transit usage (the 70% contour) would be enlarged by no more than 1 or 2 miles under the extreme transit-oriented system. It is evident that extensive rapid transit facilities may be expected to attract considerable passengers in the outskirts, but will not materially reduce automobile movement in the central zones.

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*The data and drawings which follow are based on the simulation of traffic during the average afternoon peak-hour. While it would have been possible to develop a model which simulates off-peak and all-day traffic, it was considered that the determination of peak-hour traffic would be adequate for evaluating most of the area's transportation needs, with the possible exception of facilities required to serve major specialized recreational uses.

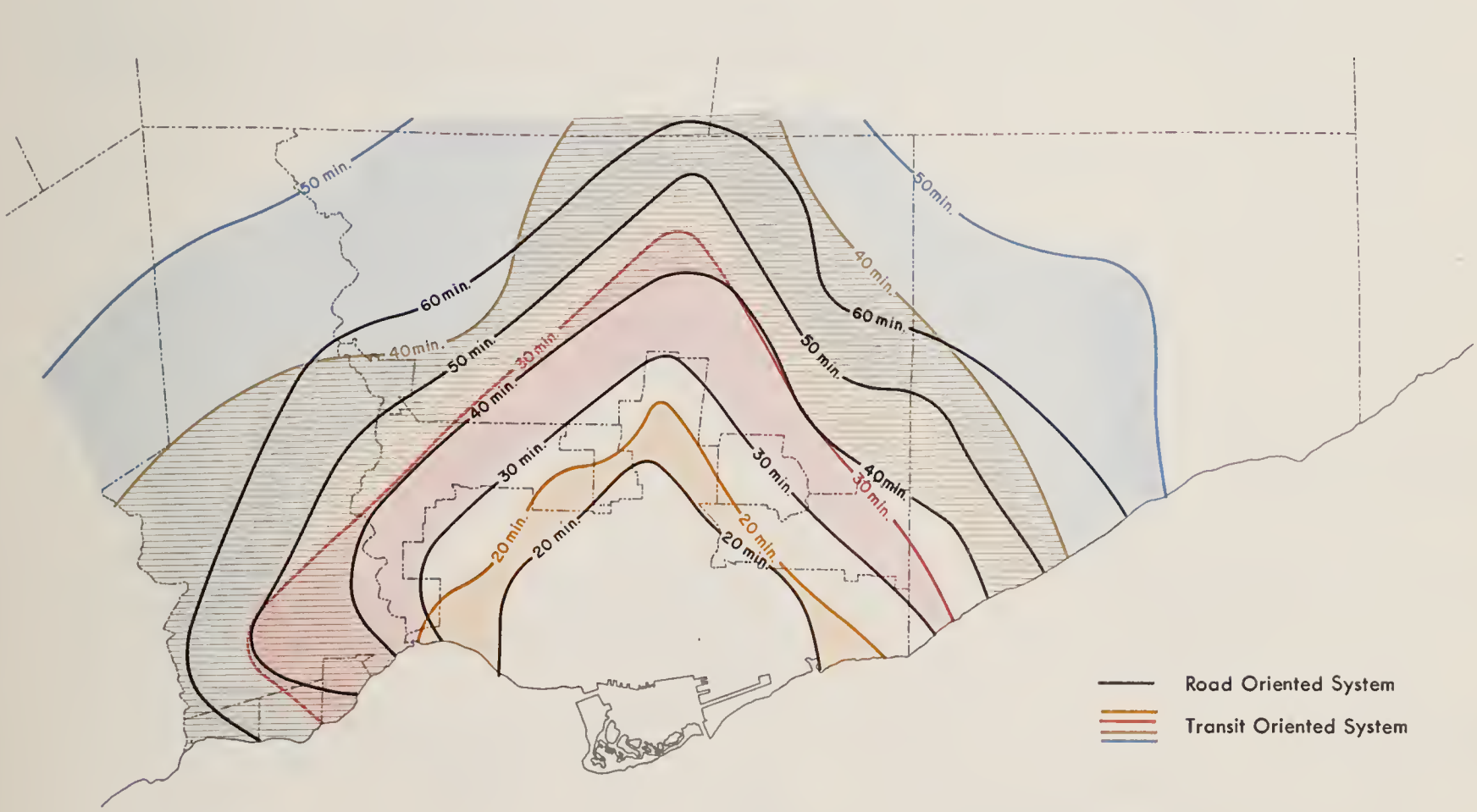
**For technical reasons, the assumed projections of personal income in this series of studies were lower than might reasonably be expected in 1980. It is likely, therefore, that transit riding has been over-estimated in both plans, and that transit usage would in fact be lower than shown for either system. However, since the income assumptions were identical for both plans, the results are comparable with each other.

Road Oriented System

Transit Oriented System

Figure 19—TRANSIT TRIPS AS PERCENT OF ALL PEAK-HOUR TRIPS

Vehicle Travel Times



Transit Travel Times

Figure 20—COMPARATIVE TRAVEL TIMES FOR EXTREME STUDY PLANS

It is also apparent that the extensive provision of transit facilities will not have a great effect on travel times in the central zones. This may be seen in Figure 20, in which it is shown that travel time will be improved only nominally for transit trips originating within a distance of about 3 miles from the centre of the city, and will remain practically constant for auto trips originating within a distance of up to 5 or 6 miles. However, beyond the central zones, travel time by transit may be expected to be reduced by about ⅓, and for transit trips from the outskirts to the centre average travel time could be reduced by as much as 20 to 30 minutes under the extreme transit system.

For auto trips, time savings under the road-oriented system would be substantial only in very limited areas, notably those served by the extensions of the Gardiner and Spadina Expressways and Highway 400. By contrast, in Etobicoke, the lakeshore suburbs and Toronto Township, travel time by car would be noticeably faster with a transit-oriented system than with a road-oriented system. It is evident, therefore, that the gain achieved by the more extensive expressway system would generally be cancelled out by the greater congestion resulting from lower transit usage.

TABLE 7—COMPARISON OF BALANCED AND EXTREME SYSTEMS

	Balanced System (D-4)	Road-oriented System (C-3)	Transit-oriented System (C-5)
Facilities			
1. Miles of expressway	175 miles	177 miles	81 miles
2. Miles of rapid transit	29 miles	14 miles	88 miles
Total System performance			
3. Total travel time	261,000 hours	281,000 hours	249,000 hours
4. Average trip length	9.9 miles	8.9 miles	9.3 miles
5. Average trip speed	20.6 m.p.h.	16.8 m.p.h.	19.7 m.p.h.
6. Average trip time	28.9 min.	31.9 min.	28.3 min.
Vehicle performance			
7. Vehicle trips	245,000	236,000	
8. Vehicle miles	2,770,000 miles	2,541,000 miles	
9. Average vehicle speed	26.5 m.p.h.	22.7 m.p.h.	
10. Average speed on expressways	38.9 m.p.h.	30.9 m.p.h.	
11. Average speed on arterials	21.9 m.p.h.	18.1 m.p.h.	
12. Average trip length	11.3 miles	10.8 miles	
13. Average trip time	25.6 min.	28.5 min.	
Transit performance			
14. Transit trips	206,000		310,000
15. Transit passenger miles	1,558,000 miles		2,506,000 miles
16. Average transit speed	13.2 m.p.h.		18.9 m.p.h.
17. Average trip length	7.6 miles		8.1 miles
18. Average trip time	34.2 min.		25.6 min.
System Efficiency			
19. Vehicle miles per expressway mile	6,300	7,000	
20. Passenger miles per rapid transit mile	20,600		10,100

OPERATION OF A "BALANCED" TRANSPORTATION SYSTEM

The studies described above have demonstrated that there is a natural tendency toward achieving a degree of "balance" in any urban transportation system. Because of this balancing mechanism, even extreme measures favouring either public or private transportation will have only a modest effect on the operation of the system. It is also likely that a desirable or "balanced" transportation system would operate somewhere in between the limits established by the extreme systems.

The results which could be expected from a balanced transportation system, as compared to either of the extreme systems, are summarized in Table 7 and illustrated in Figure 21. This comparison is based on an evaluation of the final transportation plan recommended in this report, which is described in detail in Chapter VII. Essentially it is a modified version of the preliminary plan, comprising about 175 miles of expressway, 29 miles of rapid transit, a wide network of express buses feeding the subway system, and several extensions to existing roads.*

It is clear, first of all, that a balanced system results in higher average trip speeds than either extreme system. Average auto speed is about 4 miles per hour faster than on the road-oriented system; the gain is particularly evident on the expressway network, where the balanced system leads to speeds that are higher by about 25%, or 8 miles per hour. This greatly superior performance results from the addition of some 15 miles of rapid transit to the system, together with express bus service, and illustrates the considerable benefits which the automobile driver derives from a well developed transit system.

Advantage is taken of the benefits gained from the higher speeds in the balanced system in two ways: First, by reducing the time spent in travel (a net gain of about 15% for the average trip); and second, by facilitating longer trips, or expressed differently, making possible greater mobility and wider choice of trip destinations. This latter advantage is evident in contrast to the transit-oriented system as well as to the road-oriented system.

The efficiency or utilization of the expressway network is about 10% lower in the balanced system than in the extreme road system. This is more than balanced by the fact that the utilization of the rapid transit system is more than twice as great as in the transit-oriented system.

The inability to rely on either type of extreme system is emphasized by the fact that both would lead to a very substantial amount of congestion on the street network. This is illustrated on Figure 22. As might be expected, congestion would be greater in the transit-oriented system, but not to a large degree. About 32 miles of roadway would be severely congested in the transit-oriented system, as against 28 miles in the road-oriented system.** In the former case, this congestion would centre largely in four or five general areas (mainly southern Etobicoke, the Downsview area, the northwest section of Scarborough, and particularly the general area comprising North Toronto, Leaside and Don Mills). In the road-oriented system the areas of severe congestion would be more widely dispersed.

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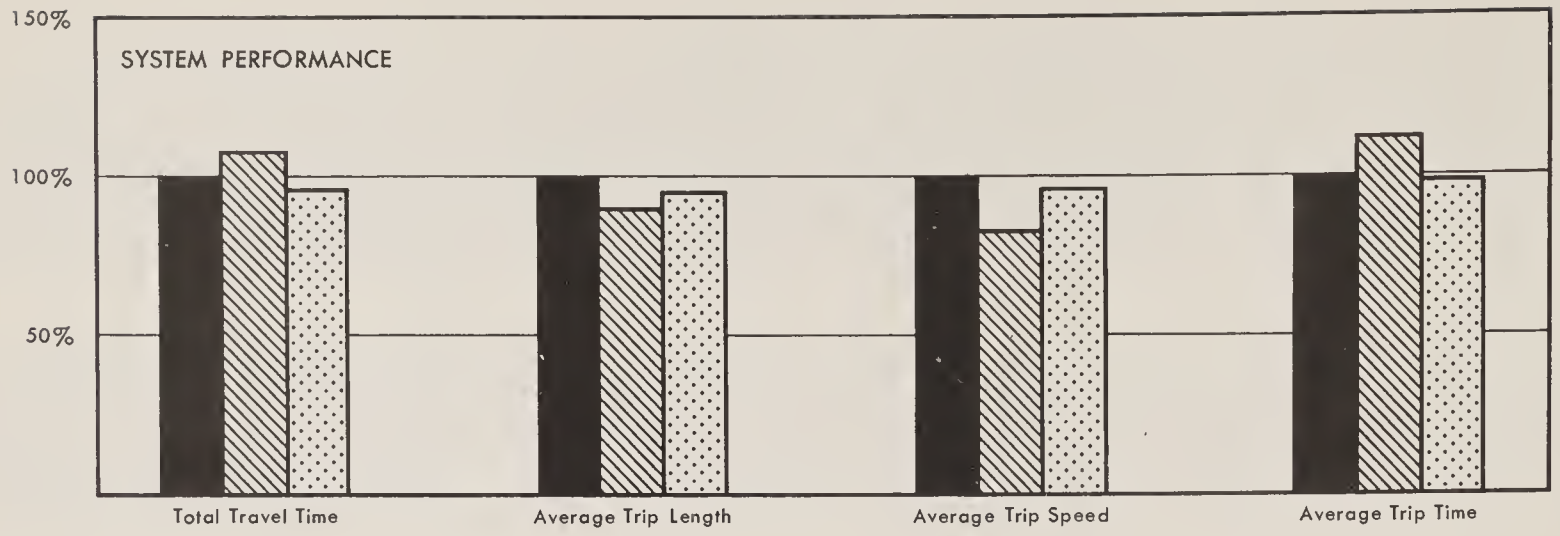
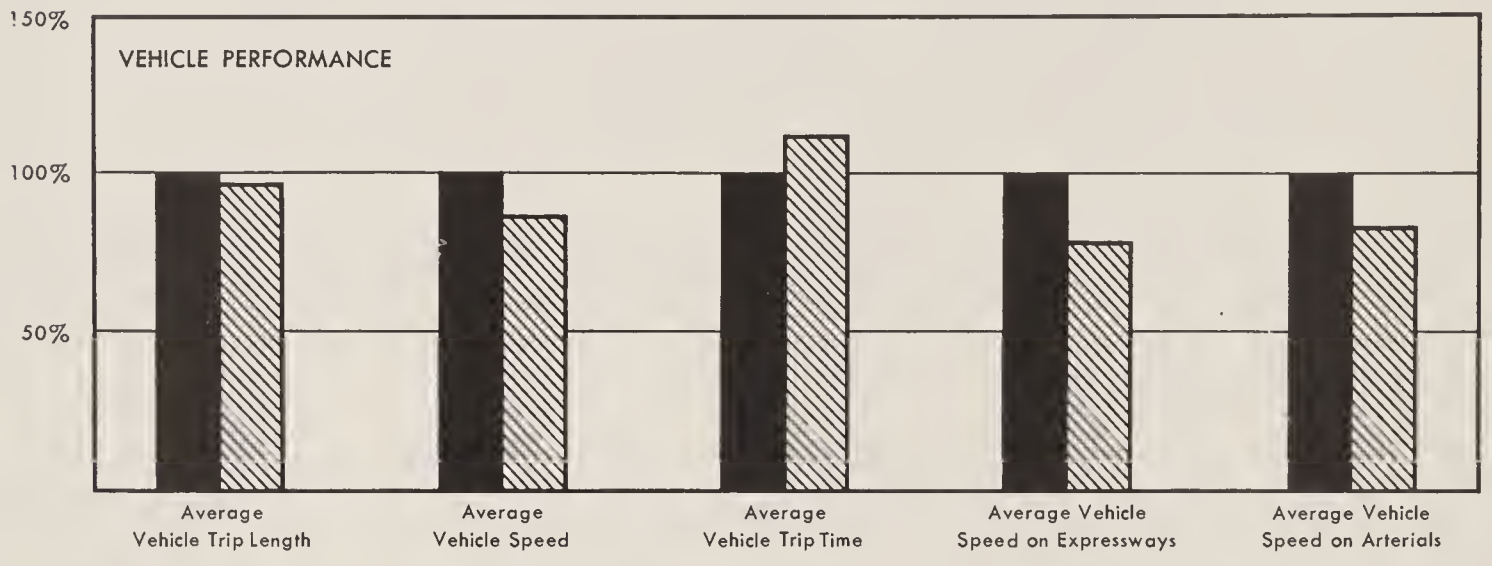
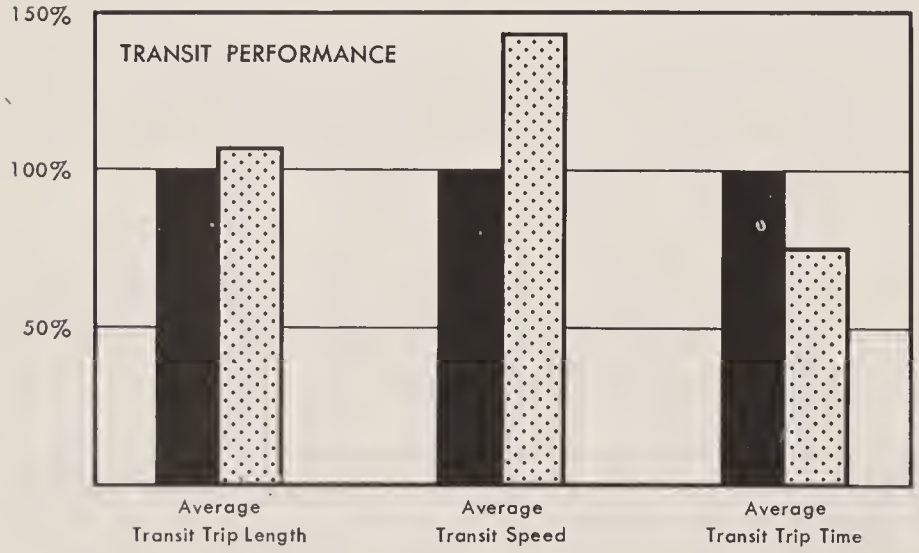
*As noted in Appendix B, the recommended plan (D-2) contains higher and more realistic income assumptions than were used for the "extreme" systems. The "balanced" plan described in this section (D-4) was based on a reduction of average per capita income in order to make the results comparable with those of the extreme systems. It should also be noted that the expressway mileage (175 miles) is a "computed" figure, which is comparable to the 197 miles contained in the final recommended plan; the "computed" rapid transit system of 29 miles is comparable to the 30½ miles in the recommended plan.

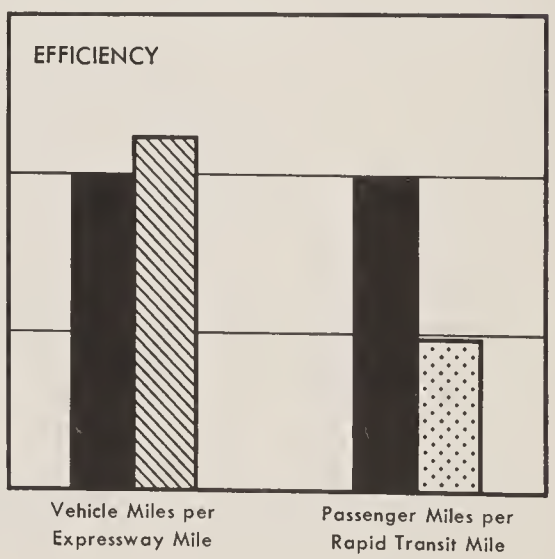
**"Congestion", as illustrated on Figure 22 (and Figure 37) occurs where traffic volumes exceed the "practical capacity", of the section of road in question. In general, "medium" congestion occurs where traffic volumes are approaching "maximum capacity" and "heavy" or severe congestion where volumes are shown to exceed "maximum capacity". Typical average travel speeds maintained under these conditions are as follows;

	Free-flow	Medium Congestion	Heavy Congestion
Central area (10 traffic signals per mile)	12 m.p.h.	Under 10 m.p.h.	Under 7½ m.p.h.
Suburban area (3 signals per mile)	17 m.p.h.	Under 12 m.p.h.	Under 10 m.p.h.
Expressways	35 m.p.h.	Under 20 m.p.h.	Under 15 m.p.h.









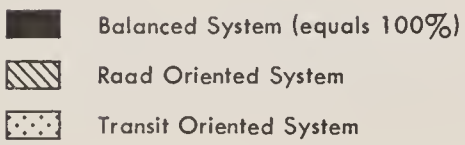
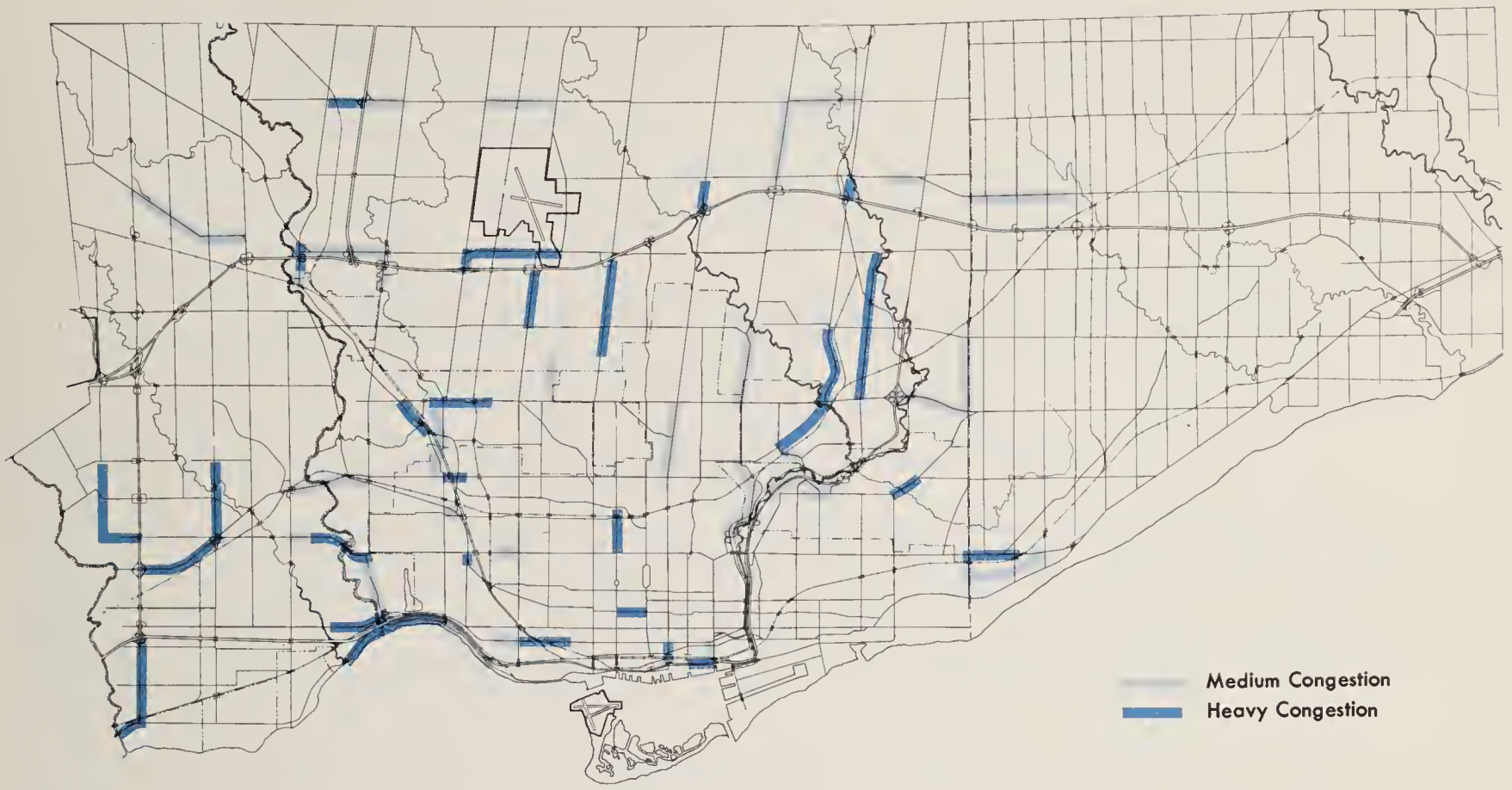


Figure 21—COMPARISON OF BALANCED AND EXTREME SYSTEMS



Road Oriented System

Transit Oriented System

Figure 22—VEHICULAR CONGESTION

Chapter V

CONCLUSIONS CONCERNING ROAD SYSTEM

NEED FOR COMPLETE SYSTEM OF EXPRESSWAYS AND ARTERIAL ROADS

Although "system balance" implies that public and private transportation should be given equal attention in developing the total transportation system, it is clear that an adequate functioning road system is basic to the plan. The comparative studies described earlier demonstrated the serious shortcomings of attempting to accommodate the future growth of the area without providing adequate expressway facilities, and this is equally true of the arterial road network, which provides the basic means of land use communication.

The road system is of course essential for peak-hour purposes, both to handle the great volume of automobile traffic and because the transit system depends heavily on an efficient road system for the surface and feeder bus services without which it could not operate effectively. Beyond this, as discussed in Chapter I, roads are the principal method of handling off-peak and week-end travel. In addition, they are essential for truck movements, and are thus an indispensable element in the economy of the community.

It was noted earlier that the road system—and particularly the expressway system—will always be operating at or close to capacity. The fact that expressways are always fully loaded reflects another important aspect of the natural tendency toward a balanced use of facilities. Drivers will use expressways in preference to arterial roads up to a point where the resultant congestion slows down expressway travel to a speed only moderately higher than that on arterial roads. The study shows that this balance generally is reached when the average expressway speed is about 40% to 70% higher than the average speed on the arterial road system. Consequently the differences in speed between the various models are surprisingly low, averaging generally between 18 and 20 miles per hour on arterial roads and between 25 and 35 miles per hour on expressways, which is only one-half of the legal speed permitted on expressways.

It would be futile to attempt to create an "ideal" expressway system which could provide travelling speeds approximating legal speeds. This would merely increase the length of the detours which drivers would make in order to use the expressways and thereby increase total vehicle-miles without bringing about a corresponding decrease in total travelling time. It would not even bring about a decrease of the traffic load on arterial roads, but would merely shift that load from roads paralleling the expressways to roads leading to expressway interchanges. Because such an "ideal" expressway system would require a closely spaced expressway grid, practically all arterials would serve as feeders to some expressways as well as acting as parallel roads to others; hence the arterial system would require about the same capacity as would be required without the "ideal" expressway system.

Therefore no attempt should be made to create an "ideal" expressway system, with a capacity sufficient to accommodate all potential users at legal speeds during peak hours. As noted above, an expressway system is of great value for trucking and for automobile travel at off-peak hours and on week-ends. For these demands the expressway system should generally supply a capacity sufficient for movement at or close to legal speed.

Simulation of off-peak hour traffic or of truck traffic has so far not been undertaken, but general knowledge of the ratio of this demand to peak hour demand, applied to the peak hour loads found in this study, indicates that the system of expressways and arterial roads proposed in the Draft Official Plan and modified in the present report will be generally adequate for this purpose. At the same time the fact that practically every link of these expressways will be fully loaded during peak hours indicates that they will be required to avoid excessive congestion on the arterial road system.

In Chapter VII, it is pointed out that by 1980 arterial road congestion will focus very largely on the inner built-up areas. By contrast many arterial roads, mostly in the outer portions of Metropolitan Toronto and the Planning Area, show a considerable theoretical "excess capacity." It is not considered proper to reduce the proposed capacity of these roads for the following reasons:

1. In addition to the "inter-zone" movements simulated in the studies, these roads also have to accommodate a sizeable volume of short "intra-zone" trips.

2. Unforeseeable variations in local land use may generate concentrations at many points along these roads. Reserve capacity is also required for other unpredictable events, such as temporary road closings and adverse weather conditions, as well as for variations within the two-hour peak period.

3. A further increase of traffic after 1980 must be expected. Therefore ample rights-of-way should be reserved wherever possible. Actual paving of lanes can be deferred until the gradual increase in traffic volume indicates the need for additional pavement.

ACCESSIBILITY TO THE EXPRESSWAY SYSTEM

It was stated earlier that maximum utilization of the expressway network is a basic objective of the transportation plan. With an "ideal" expressway network no section of the area would be very distant from an expressway facility, but it is obvious that not all parts of the area can be provided with an equal level of expressway service. Nevertheless examination of the degree of service rendered by the expressway system to the different sectors can indicate whether there are any serious shortcomings in the general design of the network.

For this purpose reference is made to the tributary areas of the expressway system in the preliminary transportation plan. These are shown in Figure 23, in which the "20% usage contours" of the individual expressways are delineated. These lines define the areas within which the given expressway

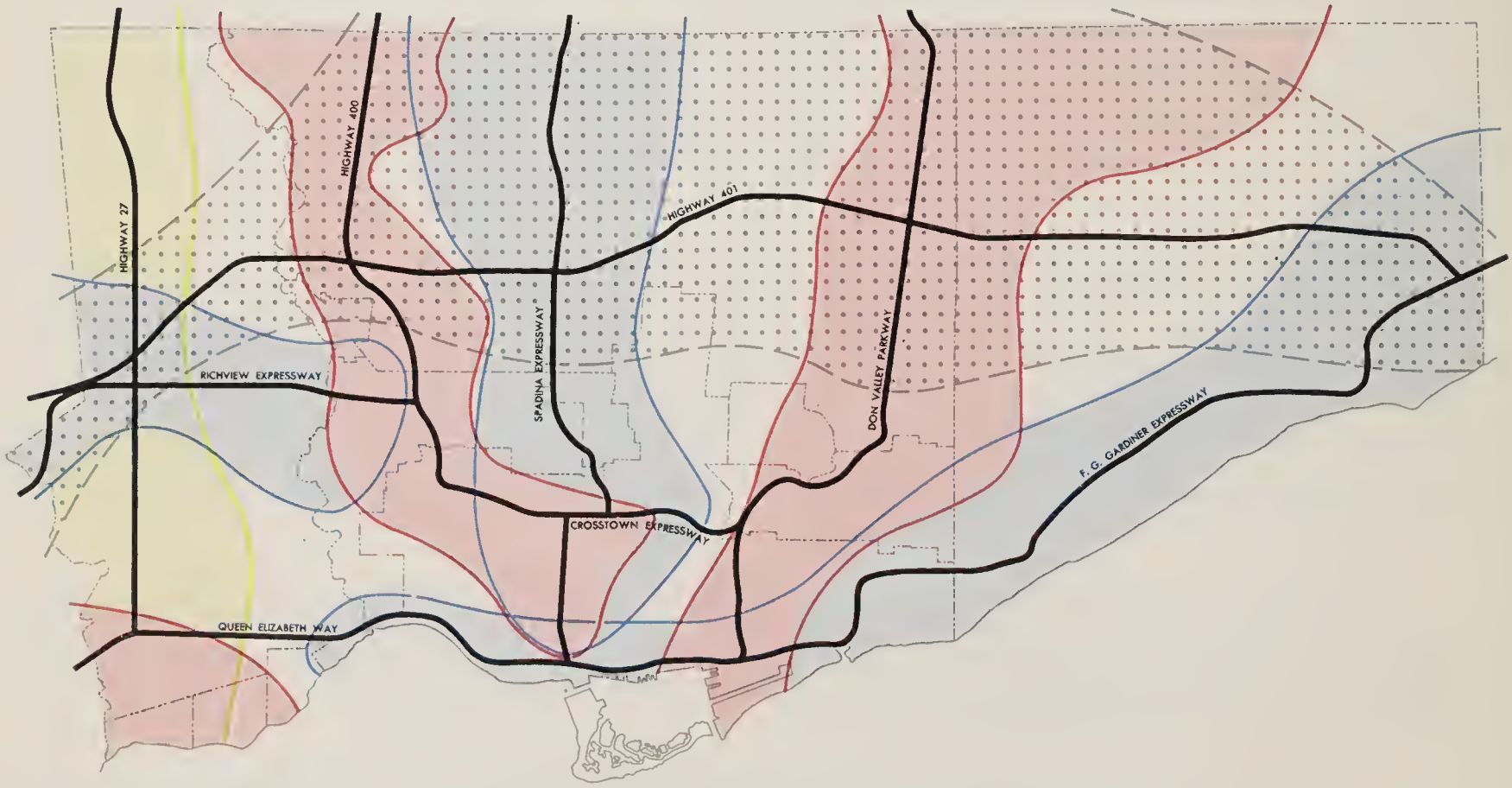


Figure 23—EXPRESSWAY TRIBUTARY AREAS
Preliminary Transportation Plan
(20% Usage Contour)

is used by at least 1/5 of all trips arriving during the afternoon peak hour. The areas falling outside these contour lines, which remain uncoloured on the map, are those areas that do not receive at least this level of service from the expressway system. The following conclusions may be drawn from this data:

a) The tributary area of *Highway 400* is shown to narrow considerably at Sheppard Avenue. This results largely from the fact that no interchange is provided at this point, and also because the lack of a crossing at the Humber River barrier in this location has served to distort natural traffic patterns from Highway 401 north. This situation is reflected in congestion over a rather wide area, and it is likely that provision of an interchange at Sheppard Avenue, and possibly an extension of this road across the river would provide considerable relief and better service to this area.

b) An extensive section of Etobicoke, Swansea and the west end of Toronto would receive relatively poor service from the expressway system. The principal cause is probably the absence of any interchange on the *Queen Elizabeth Way* in the 4-mile section between the Humber River and Highway 27. The provision of interchange facilities at Islington/Kipling (which has since been approved by the Department of Highways) will help to correct this situation and will also facilitate improved feeder bus service into the Bloor subway. The provision of a direct north-south connection between Highway 400 and the Gardiner Expressway also merits serious consideration. (This is discussed below.)

c) The tributary area of the *Gardiner Expressway Extension* through Scarborough appears to be seriously distorted. The narrow tributary area arises in part from the location of the road close to Lake Ontario, but the shallowness of the tributary area to the north is less readily explained. This distortion is reflected in a corresponding enlargement of the area tributary to the *Don Valley Parkway.* The reasons for this situation may be that the interchanges projected for the Gardiner Expressway are inadequate, that they are poorly located in relation to the north-south arterial roads, or that the east-west roads feeding into the Don Valley Parkway have a higher efficiency than the north-south roads providing approaches to the Gardiner Expressway.

d) The remaining area shown to have poor accessibility to the expressway system is the belt which lies between the *Spadina Expressway* and the *Don Valley Parkway.* North of St. Clair Avenue these facilities are about 6 miles apart, compared to a distance of 2 to 3 miles between the Spadina Expressway and Highway 400. This situation is reflected in a high degree of congestion in the general area between these two expressways. As it is not possible to introduce an additional expressway into this corridor without excessive land use and community disturbance, additional arterial road capacity and improved transit service are both urgently required.

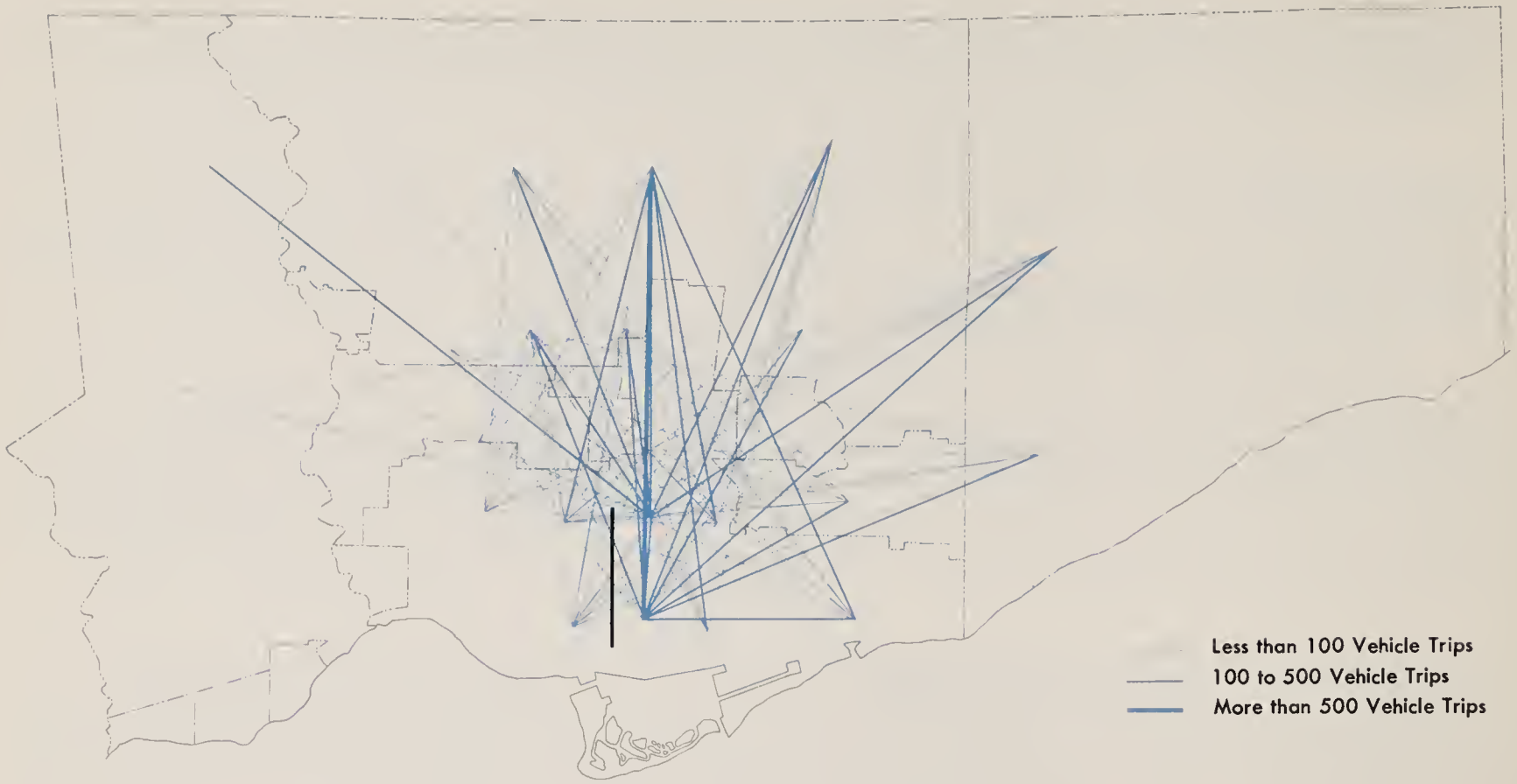
The efficient operation of the total road system depends in large part on suitable interaction between the expressway and arterial road networks. Omission of necessary interchanges between these two systems can result in marked distortion of the traffic pattern, with some parts of the system becoming overloaded and others remaining underutilized.

Provision of expressway interchanges at reasonably regular intervals facilitates a full utilization of the expressway system and maximum accessibility between the system and surrounding areas, and also permits a balanced distribution of traffic onto and off of the expressways. For this purpose, interchanges should generally be spaced no farther than 1½ miles apart, though there will always be some locations where such spacing is not feasible or necessary.

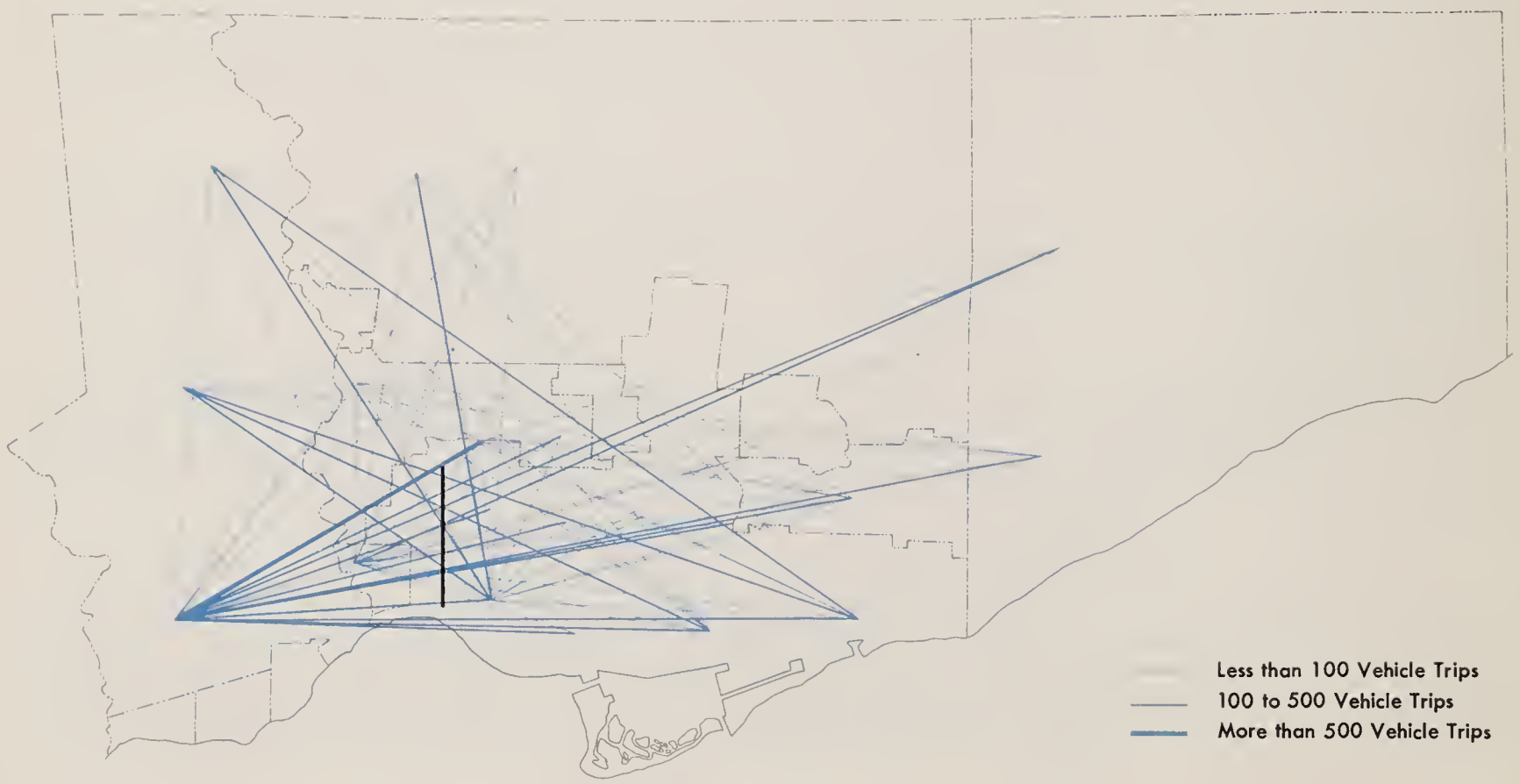
From an examination of the projected data, it appears that many of the interchange locations require systematic review. As already noted, the entire interchange pattern of the Gardiner Expressway system through Scarborough requires further study and this also applies to Highway 27 and Highway 407 north of the Metropolitan boundary. New interchanges at Highway 400/Sheppard and at the Queen Elizabeth Way/Kipling/Islington are clearly indicated. In addition, serious consideration should be given to possible interchanges at Highway 400/Steeles, Highway 401/McCowans and Highway 401/Brock Road.

HIGHWAY 400 EXTENSION

It was noted above that the expressway service pattern might be improved in the west end of Toronto by the provision of an additional or alternative connection between Highway 400 and the Gardiner Expressway. In the preliminary transportation plan, it was proposed that Highway 400 be



Spadina-Christie Alignment



Keele-Parkside Alignment

Figure 24—HIGHWAY 400 EXTENSION DESIRE LINES
(Alternative Alignments)

extended to the Gardiner Expressway on a route in the vicinity of Christie/Clinton Streets. An alternative arrangement has also been studied, with Highway 400 being extended directly south in the vicinity of Keele/Parkside, and the Spadina Expressway being extended as a "junior" expressway along Spadina Avenue.

The comparative results of this study are shown in Figure 24, which diagrams the trips which would be made on an expressway in the Keele/Parkside location and by an expressway in the Spadina/Christie location.*

Each of these expressways would carry similar traffic volumes, from 3,500 to 4,000 vehicles at peak-hour (assuming that both were in operation concurrently), but the character of the traffic loads and the areas served would be quite dissimilar. A Christie (or lower Spadina) Expressway would serve a relatively concentrated area, covering about 70 square miles and with the longest trip running about 9 or 10 miles. A Keele/Parkside Expressway would provide service to a much more extensive area, covering about 120 square miles and with trips up to a distance of about 15 or 16 miles. On the Keele/Parkside Expressway the majority of the trips would be through trips, using this road as a link between the Gardiner Expressway and the Queen Elizabeth Way to the south and Highway 400, the Crosstown Expressway, the Don Valley Parkway and the Richview Expressway to the north. On the Christie/Spadina Expressway only about ¼ of the trips would be through trips, the majority being trips into or out of adjacent areas or the central area.

Because of the different traffic patterns served, it may ultimately be advisable to build both expressway connections to the Gardiner Expressway. The Christie/Clinton Expressway is required as an essential link in the inner expressway loop which distributes traffic into and out of the central area and provides a by-pass route for this area. The Keele/Parkside Expressway may be required as a future west-end loop which among other things would provide a badly needed north-south truck route through an area in which existing truck route facilities are severely deficient.

Preliminary studies indicate that such an expressway could be constructed with minimum damage to residential and community amenities and at a reasonable cost. However, the matter of a suitable connection to the Gardiner Expressway and the distribution of interchange movements would require much more study. As the full implications of this proposal are not yet known, and as its need appears considerably less urgent than that of the Christie/Clinton Expressway, it is considered that only the latter facility should be incorporated in the present stage of the transportation plan (covering a period of up to 15-20 years).

CROSSTOWN EXPRESSWAY

The question of the Highway 400 Extension is closely related to that of the Crosstown Expressway, which is designed primarily for three purposes: To provide a connection between the three north-south expressways feeding the central area (Highway 400 Extension, Spadina Expressway and Don Valley Parkway); to distribute traffic between these expressways and the central arterial road system; and as a link in the inner ring, serving as a by-pass route for through traffic.

All of the alternative models which included this expressway showed that it would be heavily used, with traffic volumes between 6,000 and 10,000 vehicles per hour, almost evenly divided in both directions. The pattern of traffic flow on the Crosstown Expressway is shown in Figure 25. About ⅓ of the cars would be using the facility as a direct connection between the three north-south expressways noted. Most of the remaining traffic would be using it as a connection between these expressways and the intersecting arterial streets feeding the central and mid-town areas. About 5% of the traffic would be using the expressway solely as a connection between arterial streets.

The first, immediate effect of not constructing the Crosstown Expressway would be an attempt by these same vehicles to use the parallel east-west streets. A second effect would be a substantial re-distribution of traffic on the intermediate expressway ring (Highway 400, Highway 401, Don Valley Parkway, Gardiner Expressway).

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*The diagram illustrates the trips which would utilize a "junior expressway" along Spadina Avenue. This is considered also to be representative of the trips which would utilize a Christie/Clinton Expressway (¾ mile to the west).

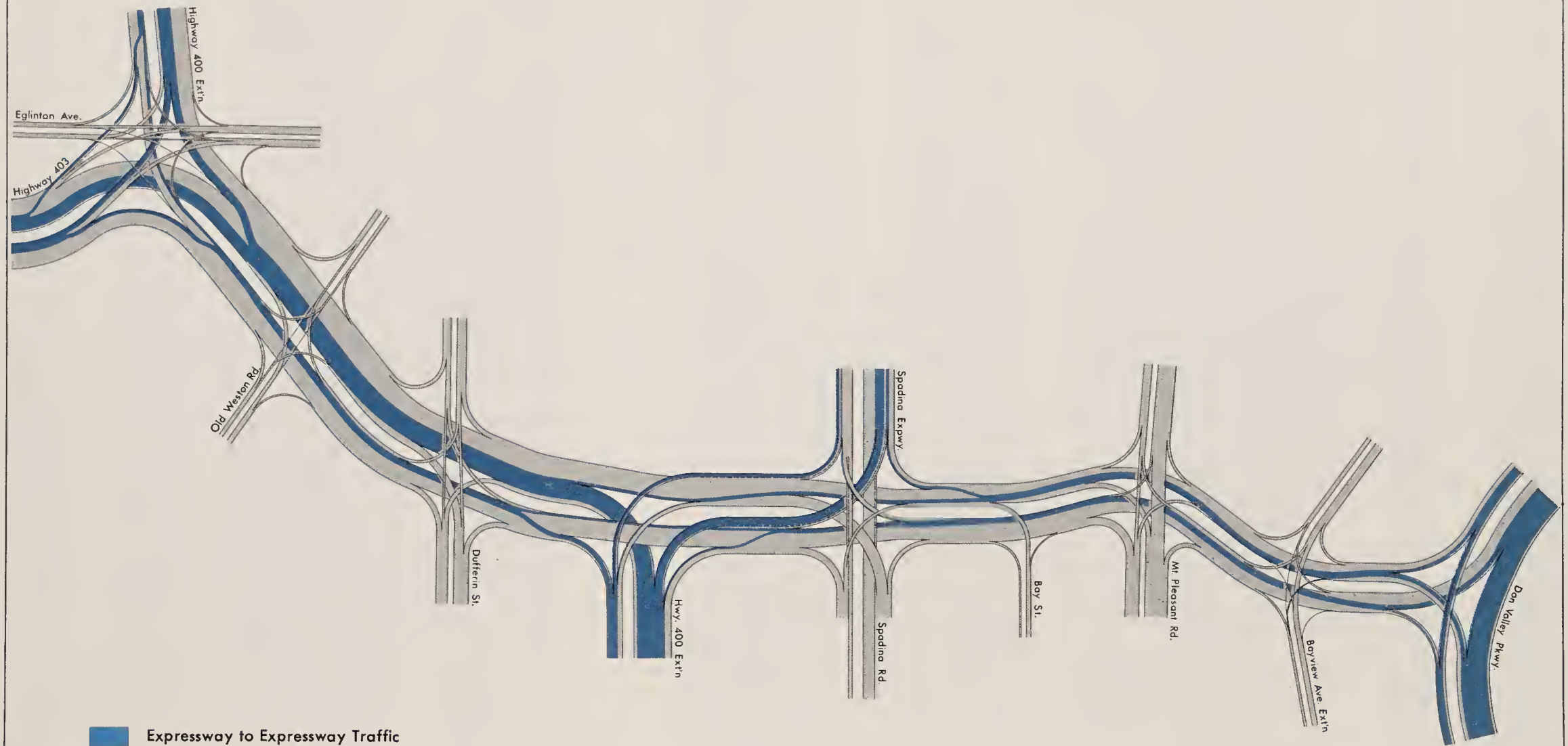

Figure 25—CROSSTOWN EXPRESSWAY AND HIGHWAY 400 EXTENSION
(1980 Simulated Vehicle Volumes)

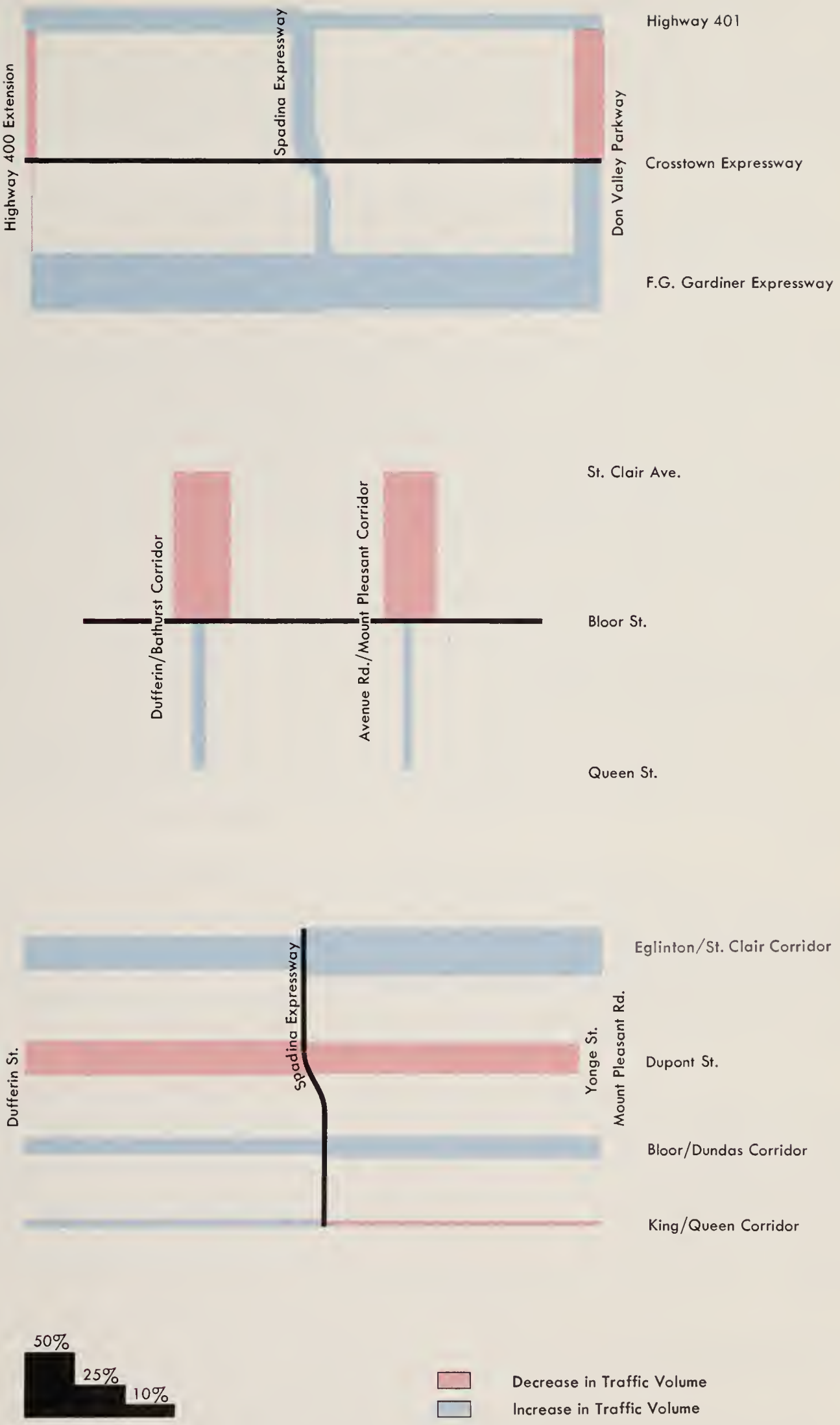

Figure 26—EFFECT OF DELETING CROSSTOWN EXPRESSWAY

The effect of eliminating the Crosstown Expressway from the transportation system is indicated on Figure 26. The greatest impact would be on the east-west streets in the St. Clair/Eglinton corridor, where traffic volumes would increase by 20% to 30%, and on streets in the Bloor/Dundas corridor, where the increase would be around 10%. Conversely, traffic would decrease on Dupont Street and the north-south streets connecting Bloor to St. Clair if the Crosstown Expressway were *not* constructed. This is because these streets perform the essential function of distributing traffic onto and off of the Expressway.

The impact on the expressway system would also be heavy, with traffic loads increasing by ⅓ on the Gardiner Expressway and by about 10% to 15% on the Spadina Expressway and Highway 401 if the Crosstown Expressway is not built. (The former situation would be most acute, as this section of the Gardiner Expressway is on elevated structure and its capacity cannot be expanded.) On the other hand, the section of the Don Valley Parkway running north from Bloor Street would evidently become seriously overloaded if the Crosstown *is* built, and because of this it appears that its capacity should be reduced to four lanes east of Yonge Street or Bayview in order not to overload the Parkway.

The general increase in congestion which could be expected if the Crosstown Expressway is not built would ultimately result in adjustments to travel habits. This process of adjustment has been simulated by the model in various forms: choice of other routes, change from driving to transit riding, and change in trip distribution. The ultimate effect is expressed as a net increase in total travel time on the transportation system, amounting to some 5,000-6,000 hours. This is equal to about 2% of the total peak-hour travel time on the entire system and represents the effect which would flow from the elimination of a single facility.

It is clear that the Crosstown Expressway is an essential element in the future transportation system. As is the case with any inner-city expressway, its location and design will have to be handled carefully to minimize the impact on adjacent land uses and to provide the most effective interchange with the intersecting street system.

The relocation of the expressway route from its original alignment south of Dupont Street to the hydro lines north of the C.P.R. tracks will reduce the effect on nearby residential areas to a minimum, as will the proposed tunnel east of Yonge Street under the tracks and the Rosehill escarpment. Altogether, it is likely that the expressway will displace less than 100 houses, a very modest figure for a mid-town expressway.

The connections to the street system are a more serious matter. It is necessary, for example, that the connection at Mt. Pleasant Road should be designed so as to restrict traffic movement into the adjacent residential areas. Because neither Yonge Street nor Avenue Road are able to handle any additional traffic, the basic midtown connection should probably be made to an extension of Bay Street, and the matter of providing for one-way traffic on Bay and Church Streets will also require study. Perhaps the most serious problem is how to provide adequate capacity on Dupont and/or Davenport to distribute Crosstown traffic to the intersecting arterial streets.

Both the Crosstown Expressway and the Christie Expressway are essential legs in the inner expressway loop. Half of this loop is already in operation (Gardiner Expressway and Don Valley Parkway); until the loop is completed, there will be no effective way of providing for through traffic to by-pass the central area (at least not without overloading the two existing expressways), and there will be no effective way of distributing the traffic from the three north-south expressways. It is not likely that the essential east-west distribution function can be handled by existing streets. Even the most radical improvement of the Dupont-Roxborough route from Bathurst to Mt. Pleasant Road would not be a nearly adequate substitute for the Crosstown Expressway, and would probably have a greater impact on existing community amenities.

SPADINA EXPRESSWAY

The Spadina Expressway, presently under construction, was approved by the Metropolitan Council in 1962 and by the Ontario Municipal Board in 1963. In its decision, the Board indicated that the capacity of the road should be restricted to 4 lanes (2 in each direction) at the southern end until adequate facilities are available to distribute traffic from the full 6-lane facility. At the northern end,

the approved expressway terminates at an interchange with Wilson Heights Boulevard about 3,000 feet north of Wilson Avenue.

The adequacy of the existing arterial roads to handle the Expressway traffic at the terminal ends has been examined. At the northern end it has been concluded that the expressway should be continued north to the intersection of Sheppard Avenue and Dufferin Street. North of this point it will be sufficient if Dufferin Street is improved as a 6-lane controlled access road to its intersection with Highway 7.

At the southern end, instead of terminating the expressway between Dupont Street and Bloor Street, it will be necessary to extend it below Bloor Street. South of here Spadina Avenue will be adequate for the projected traffic movements, with certain intersection improvements required in order to take full advantage of the existing 8-lane width of this street.

These projections are based on the assumption that the Crosstown and Christie Expressways will be constructed to complete the inner ring. A special study which was made to determine the likely effect of not constructing the Crosstown Expressway (described above) indicated that traffic on Spadina Avenue would increase by up to 10%. However, no examination has been made of the situation which would arise if neither the Crosstown nor the Christie Expressways are built.

The only available information is derived from another study dealing with likely traffic conditions throughout the area in the years 1972-73. The Spadina Expressway will have been completed at that time, but in this study it was assumed that the Expressway is operating at its full 6-lane capacity. The results indicate that Spadina Avenue would be severely congested for its entire length down to the Gardiner Expressway, but perhaps surprisingly no serious congestion was indicated for either the north-south arterial streets parallel to Spadina nor for the intersecting streets.

These results are not conclusive. While it is quite likely that Spadina Avenue can be improved sufficiently to handle the traffic from the Expressway until it is expanded to 6 lanes, it seems highly unlikely that the 1980 traffic conditions in the central area can be met satisfactorily without the completion of the inner expressway ring.

IMPROVEMENTS TO ARTERIAL ROAD SYSTEM

The capacity of the total road system can be improved in four basic ways:

a) Increasing the capacity of existing or proposed expressways. As already noted, enlarging expressway capacity beyond the level provided for in the plan would simply lead to a reorientation of traffic movements on arterial roads, without substantially decreasing the total load on the arterial road system, and would lead to increased congestion at interchange locations. It cannot generally be recommended unless special provision is made for two levels of service (short and long distance) as in the present reconstruction of Highway 401 and the current plans for Highway 27.

b) Widening of existing arterial roads. Road widening in built-up areas results in very high costs and serious disruption of land uses, while increasing capacity by only 400 to 500 cars per lane. In addition, pavement widening beyond 6 lanes increases the difficulty of pedestrian crossings. Therefore any additional widening above the basic pavement widths recommended in this plan (4 to 6 lanes in the built-up areas, 6 lanes in the undeveloped areas) cannot be recommended as a means of providing significant improvement in the efficiency of traffic movement.

c) Building additional expressways. While this would certainly increase overall road capacity and travelling speeds, there is only one location in the built-up area (Highway 400 Extension along Keele/Parkside) where the potential traffic improvement would warrant the high cost of construction and the disruption of existing land use. It is possible that additional expressway facilities can usefully be considered in the fringe areas at some future date (for example, an eastern extension of Highway 407), but this is not a matter requiring urgent attention at this time.

d) Constructing new arterial roads. Several additions to the road system were included in the preliminary transportation plan, primarily at locations where additional crossings of rivers and other major traffic barriers are required. In addition, while the basic concession road system provides an

adequate foundation for the arterial road system, many new development areas will require additional arterial road facilities, and these can be expected to be provided in the course of development.

Most of the new roads (and jog eliminations) proposed in the preliminary plan are still considered necessary on the basis of the computer analysis, though there have been some changes in general alignment or other features. In addition, however, results of this study and other studies over the past four years have indicated the need for some new roads which were not included in the original recommendations. These include the following:

Avenue Road extension to Sheppard Avenue
Mount Pleasant Road extension to York Mills Road
Wilson Avenue connection to York Mills Road
Bay Street extension to Crosstown Expressway
Islington Avenue extension to Lake Shore Boulevard

Of the new roads originally proposed, it has been found that two roads require completely different alignments—the extension of Wilson Avenue across the Humber River to Rexdale Boulevard and the extension of Lawrence Avenue East across the Highland Creek to connect with the Base Line Road in Pickering Township (originally proposed as an extension of Coronation Drive). It has also been found that Finch Avenue West, originally proposed to be extended as far as Albion Road, should be extended further to Derry Road in Toronto Township.

The principal important deletion from the original plan involves the proposed Massey Creek Drive connection between Don Mills Road and Victoria Park Avenue. The major purpose of this road would be to serve as an indirect connection between the Don Valley Parkway and the Gardiner Expressway, and it could be considered as an "east-end loop", analagous to the suggested "west-end loop" (Keele/Parkside Expressway) discussed earlier. A detailed examination of this route has indicated that its construction would probably be very damaging to the amenities of the Massey Creek valley in the area west of O'Connor Drive. While the study results showed that the road would be of use in the transportation system, its deletion did not indicate any serious consequences in terms of congestion, and it is therefore considered unnecessary to construct this road, at least over the period envisaged in the plan. The possibility of extending Sheppard Avenue across the Humber River has also been considered, but is not proposed at this time because it requires detailed examination of its effect on the valley.

While the new arterial roads suggested, both in the original plan and in the present report, will provide much-needed road capacity, it should be noted that congestion will not be eliminated entirely even if these roads, the new expressways, and the proposed transit facilities are provided. (This is discussed further in Chapter VII, dealing with the recommended plan.) One type of improvement which will be needed is the provision of additional road crossings of Highway 401, where the spacing of road crossings is less favourable than on most of the other existing or projected expressways in Metropolitan Toronto. The areas where such crossings will certainly be required in the near future are the two concession blocks between Jane and Dufferin Streets, and the two concession blocks between Yonge and Leslie Streets. In each of these four cases a suitable mid-block crossing should be provided over Highway 401. While these future roads would be only of a collector or minor arterial character, their absence will contribute considerably to general congestion on the arterial roads connecting to Highway 401.

Chapter VI

CONCLUSIONS CONCERNING TRANSIT SYSTEM

SUBWAYS AND RAPID TRANSIT

To maximize the use of the transit system, it should be designed to produce the highest average travelling speeds and the greatest level of accessibility throughout the area. But unlike the road system full utilization of the transit system is not assured, and measures which are taken to maximize its use must fall within acceptable economic bounds. The sharp fluctuations in transit volumes between peak and off-peak periods reflect varying service requirements. The most suitable system is achieved by providing those high capacity trunk facilities which can be shown to have high usage and providing additional peak demand capacity and system flexibility by the use of various levels of surface transit operation—both for subway feeder service and for trips in areas and directions in which passenger volumes do not warrant the provision of expensive high capacity facilities.

As already noted, a rapid transit system consisting only of the Yonge-University Subway, and the Bloor-Danforth Subway (from Keele to Woodbine) would result in low average travelling speeds and a considerable loss of time, and would lead to serious road congestion. A very extended subway system (with 6 times as much route mileage) would produce fairly favourable travel speeds and time savings, but would lead to even more serious road congestion. The outer sections of such a system would carry only very light and uneconomic loads. As a result, the passenger load on the entire system (passenger miles per subway mile) would average only about 10,000 per hour during the peak 2-hour period. This is hardly a sufficient warrant for the construction of a subway system with a rated capacity of 80,000 passengers an hour in both directions, and is little more than half of the load which would be carried by either the "minimum" transit system or the "balanced" system.

The comparative studies described earlier have demonstrated conclusively that the area will be best served by neither a minimal nor an extreme rapid transit system, but by a moderate system supplemented by suitable surface transit services. The preliminary transportation plan, with 37 miles of rapid transit lines, constituted such a system, and it has been examined to determine its general effectiveness.

The tributary areas of the rapid transit system contained in the preliminary plan are shown in Figure 27. The contour lines shown indicate the areas within which different proportions of transit trips would utilize the rapid transit system. It may be seen that the areas of greatest utilization (50% or more) would lie along the Bloor-Danforth and Queen lines, but that the areas in which at least 35% of the trips use the subways are far more extensive for the Bloor-Danforth line than for the Queen line. It is particularly significant, as discussed below, that the "competition" between the east end of the Queen line and the Danforth line causes a considerable constriction in the tributary area of the Danforth line as compared to the Bloor line. It is also significant that the tributary areas of both the Yonge and Spadina lines are not very intense, again because of possible "competition".

It is clear that most of the high and medium density areas would be relatively accessible by rapid transit service under this plan. The areas which would not be well served by the rapid transit system are principally the following:

1. The Weston corridor and the northwest section of the Metropolitan area.
2. The lakeshore municipalities, to a lesser degree.
3. The Don Valley corridor.
4. Eastern and northern Scarborough.

Figure 27—SUBWAY TRIBUTARY AREAS
(Preliminary Transportation Plan)

There is little indication that extension of the rapid transit system into these areas would be justified. At present, the terminal load on the subway system (at Eglinton) averages about 11,000 persons per hour during the peak period, and about 13,000 passengers during the peak hour in this 2-hour period. Because the existing subway system is so short, this may represent a higher level than would be expected when the system is more complete, but it is not likely that the rapid transit system should be extended beyond the point where the passenger load in the main direction will average about 7,000-8,000 persons per hour during the peak period. Of the under-serviced areas noted, only the Weston area holds the possibility of providing a suitable level of demand, and this question is to be investigated during further studies.

Examination of the subway service areas has raised certain questions about the rapid transit system proposed in the preliminary plan. These are discussed below.

QUEEN STREET SUBWAY

The Queen Street Subway proposed in the preliminary transportation plan would run from Roncesvalles Avenue on the west to Greenwood on the east, and then north to O'Connor Drive, for a total length of 8½ miles. It may be seen, on Figure 27, that the tributary area of this subway would not extend generally beyond its eastern and western ends. Beyond these points the influence of the Bloor-Danforth Subway would begin to dominate, except that, as noted above, the northern extension of the Queen line would evidently cut sharply into the tributary area of the Danforth line.

This is borne out by the passenger volumes to be expected on these two lines, which are illustrated on Figure 28. If the Queen line is extended north as originally proposed, it would attract few passengers north of Danforth. South of Danforth the fairly substantial loads would be almost entirely diverted from the Danforth Subway, with passenger volumes on the latter line running about 45% lower west of Greenwood than east of Greenwood. This indicates a very sizeable diversion to the Queen line at that point, which is clearly undesirable in view of the excess capacity of the Danforth line.

In the section west of Yonge Street passenger volumes are about half as large as east of Yonge Street. If the line were not extended north to Danforth the loads on the eastern section would drop by some 40% to 50%. In this event, volumes would not approach 10,000 passengers per hour on any section of the line, and the terminal loads would be below 5,000, or less than half the comparable volumes on Bloor-Danforth. Furthermore, most of the trips on the Queen line would be relatively short, averaging about 2 miles in length compared to 4 or 4½ miles on the Bloor-Danforth line and 3 or more miles on the Yonge and Spadina lines.

If the Queen Subway is omitted entirely, the projected transit volumes in the Queen corridor could probably be handled by surface buses. However the serious congestion in this area and resulting slow movement, particularly in the central section, make it desirable to provide an improved transit service. It is suggested that the most suitable facility would be an improved tram line on its own right-of-way, underground between Spadina and Jarvis and on the surface between Spadina and the Humber Loop, and between Jarvis and Broadview or Pape.

Such a facility already exists for the 2 miles from Roncesvalles to the Humber Loop. The sections from Roncesvalles to Spadina (2½ miles) and from Jarvis to Broadview or Pape (2 miles) run through areas in which extensive redevelopment can be anticipated, and it would be possible to provide for a transit right-of-way in the course of such redevelopment. In fact, provision of an improved transit service might well be useful in stimulating desirable redevelopment. The tunnel through downtown would be a little over a mile in length, and provisions have already been made for such a tunnel under the Yonge and University Subways.

The suggested transit facility would be similar to the "subway-surface street car" to be found in Boston and Cleveland and in some European cities. Such a facility would probably achieve a travelling speed of 12-14 miles per hour, and in its central section it might carry up to 12,000 passengers in the main peak hour in each direction. Conceivably it might be continued in two branches as a normal street car line beyond the proposed terminal points.

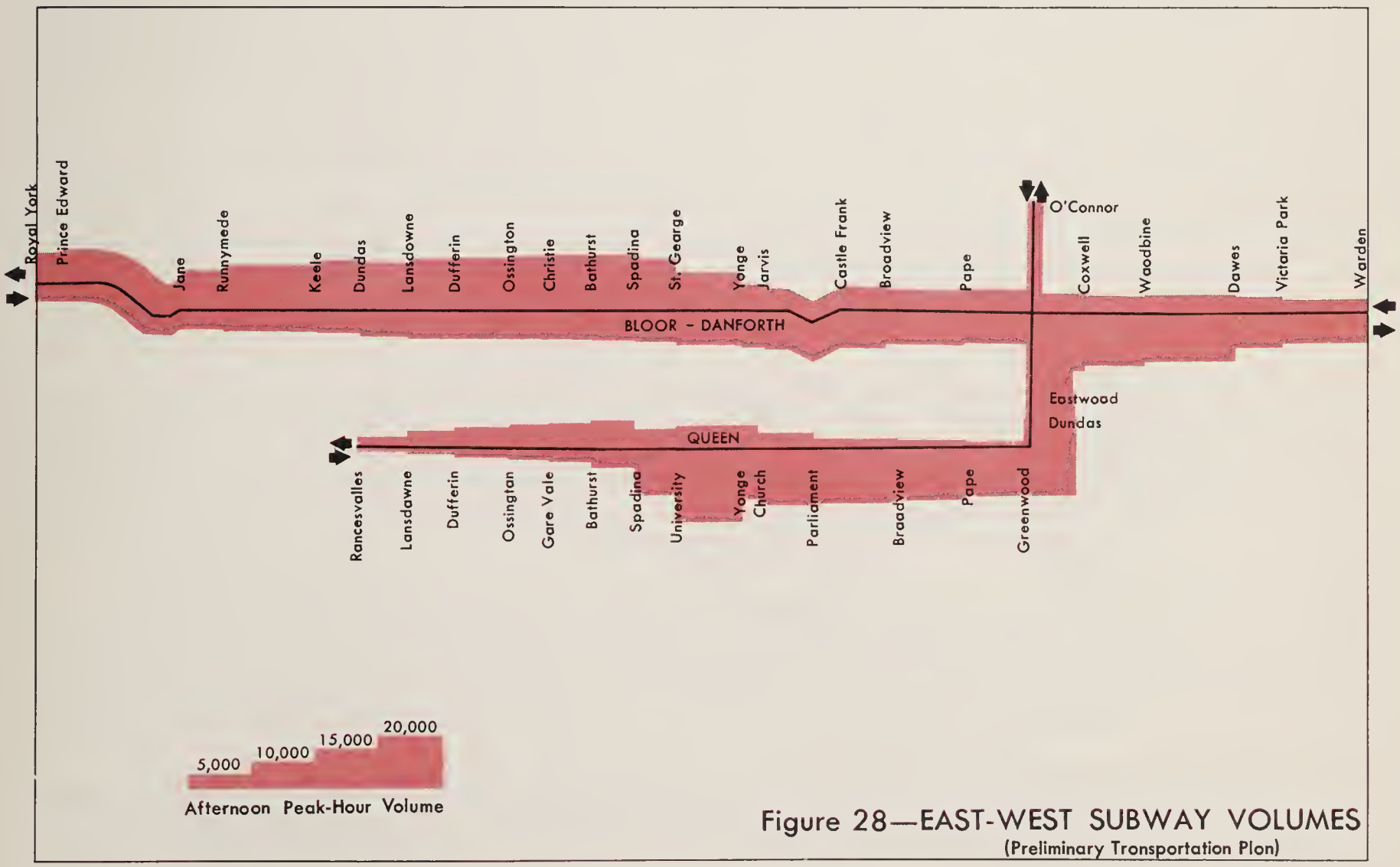

Figure 28—EAST-WEST SUBWAY VOLUMES
(Preliminary Tronsportation Plon)

The engineering and operating considerations involved in such a facility require further study, but the possiblity warrants serious consideration. There is little doubt, however, that the full-scale subway originally proposed for Queen Street is not warranted.

BLOOR-DANFORTH SUBWAY EXTENSIONS

In the preliminary transportation plan, the Bloor-Danforth Subway was proposed to run from Royal York Road in Etobicoke, to the vicinity of Warden and Danforth, in Scarborough. Subsequently, the Metropolitan Council decided to extend the subway from its original western terminal (Keele Street) to Islington Avenue, and from the original eastern terminal (Woodbine Avenue) to the intersection of Warden and St. Clair.

The decision to extend the subway was based in large part on the fact that this would bring the rapid transit system well into the suburban development areas, to points where it would be possible to provide extensive commuter parking facilities and from which an extensive network of feeder bus services could be developed. While projections of passenger volumes were not available when this decision was reached, examination of the results of the present study indicates that the decision was well justified.

The principal result of the extensions is an increase of about 25% to 30% in the projected number of passengers using the Bloor-Danforth subway. The load on the arterial street system will be reduced by about 10,000 car miles and, even more important, by about 2,000 bus miles during each peak hour. Average travelling time from the suburban areas served will be improved considerably. As may be seen in Figure 29, the area within a 30 minute transit ride of downtown will be extended by about a mile; a 40-minute transit ride from downtown will extend to a distance of about 8 miles in Etobicoke (compared to 6½ miles without the extensions) and almost the same in Scarborough.

On the basis of this data, it is evident that the decision to extend the Bloor-Danforth Subway

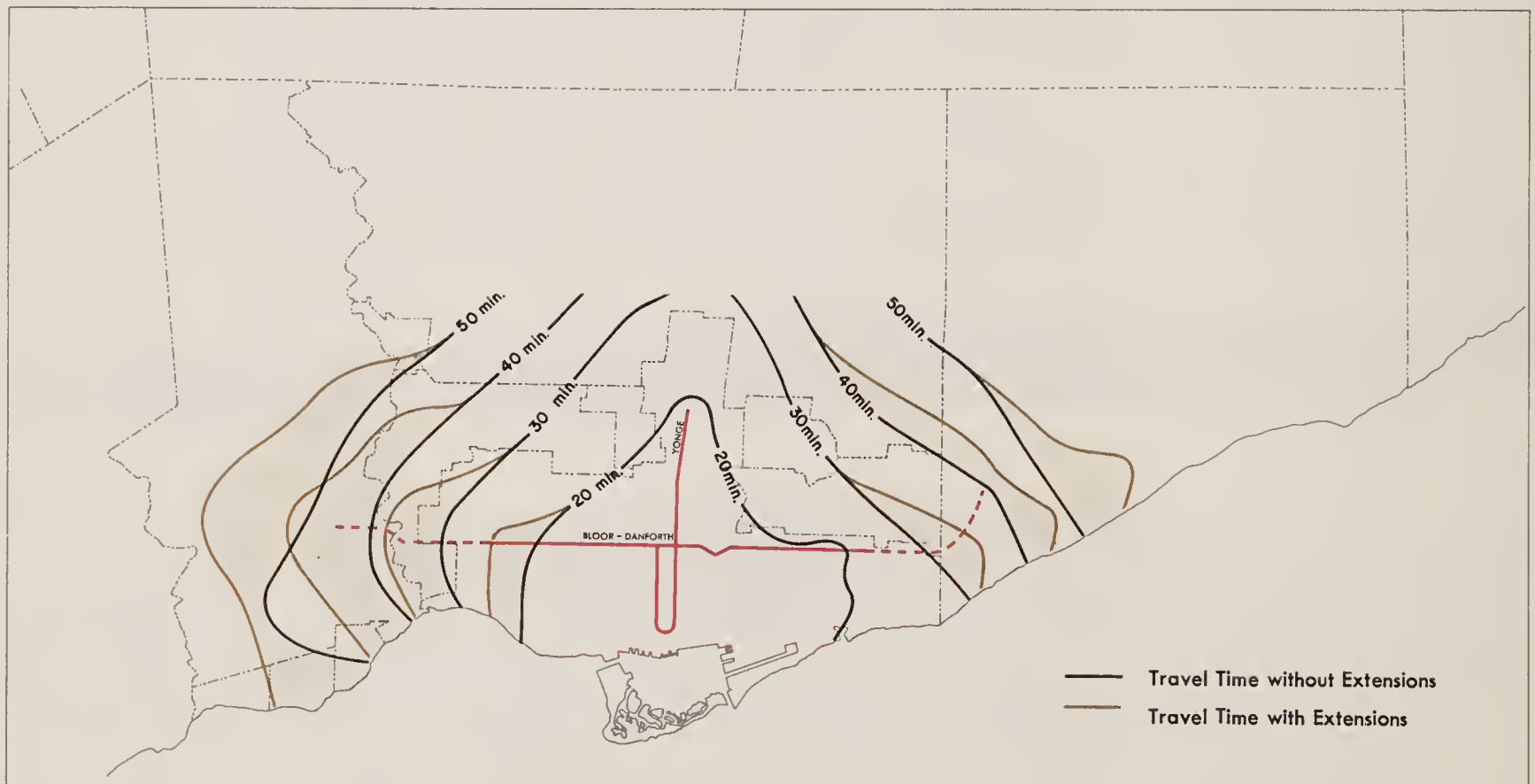

Figure 29—BLOOR-DANFORTH TRAVEL TIME
(With and Without Extensions)

from the original terminal locations will contribute to the successful operation of the transit system and to the objectives of the transportation plan.

SPADINA RAPID TRANSIT LINE AND YONGE SUBWAY EXTENSION

The preliminary transportation plan incorporated both a 4-mile extension of the existing Yonge Subway, from Eglinton Avenue to Sheppard, and a 6-mile Spadina rapid transit line. The latter facility was proposed to run underground from the St. George Station (on the Bloor and University lines), and would enter the median strip of the Spadina Expressway just east of Bathurst, continuing to a terminal at Wilson Avenue.

Both facilities had been contemplated by the Toronto Transit Commission for many years. However the Spadina route was originally intended to run south from the Spadina Expressway, in a location near Christie Street or Ossington Avenue, to Queen Street, where it would join the proposed Queen Subway. The proposal to follow the Spadina Expressway in a south-east direction and to join the University Subway at St. George Station was reached in the course of preparing the Draft Official Plan.

Since these two transit facilities would be only 2½ miles apart at the widest point, it was considered necessary in the present studies to pay particular attention to the question of whether the northern corridor would be "overserved" with rapid transit facilities. As is the case with the Queen Street line (in relation to the Bloor-Danforth Subway) it would be economically wasteful to introduce expensive parallel facilities competing for essentially the same passengers.

The results of the study are inconclusive. A comparison of alternative models which either incorporated or excluded the Spadina line indicates that construction of this facility might divert 20% to 25% of the Yonge Subway passenger volumes, and it may be presumed that the reverse would also hold true. However, the extent of this shift would be influenced by the method of operating the Spadina line at its southern end. If it is connected directly to the University Subway it may be expected to carry more passengers than if it terminates at the St. George Station, with passengers transferring to the Bloor Subway for travel to downtown via the University Avenue "Y". The final decision as to the operation of the "Y" has not yet been made, so this essential factor in the evaluation of the Spadina rapid transit line remains indefinite at this time.

It is also not known whether it will be possible or desirable to operate a rapid transit facility further to the west, along the right-of-way of the CPR/CNR main line to Weston. This possibility has emerged from the studies being conducted by the Metropolitan Toronto and Region Transportation Study, which have indicated that such a facility will be physically feasible. However, the possible passenger volumes have not yet been determined. This will depend on whether such a line would terminate at Bloor Street, with passengers transferring to the Bloor Subway at the Vincent Station; whether it could connect with the suggested "subway-surface street car" on Queen Street; or whether it could be continued directly to Union Station as a rapid transit facility.

There is no doubt, from the available information, that major transit facilities on both the Yonge and Spadina lines are essential to a well-developed transit system. The present studies and a separate study which was undertaken in connection with 1972-73 transportation requirements both indicated that the two facilities would receive a reasonable level of usage and would provide considerable benefit to the overall transportation system. However, in the latter studies it was found that the impact of the respective facilities on the total transportation system differed only fractionally.

It is evident that the question of the Yonge Subway extension and Spadina rapid transit line requires further study, particularly in relation to the possible Weston rapid transit line. The necessary studies have been initiated, utilizing up-to-date survey material secured in 1964. Among other things, the possibility of using street cars or buses to provide initial transit service on the Spadina Expressway should be considered; this is now under review by the Toronto Transit Commission.

For the present, therefore, the transportation studies indicate that both the Yonge Subway extension and Spadina rapid transit line should be incorporated in the transportation plan, though the actual form of the transit facilities to be provided may depend on the outcome of the studies now underway.

IMPORTANCE OF SURFACE TRANSIT

It was noted earlier that the level of service offered by the transit system is probably the most important factor in determining its usage, and it is therefore essential that the system be designed to provide the highest possible travelling speed. Because of this, it is desirable to secure the maximum utilization of express buses.

In the various models tested, the inclusion of express bus service produced very favourable results. Plan C-1, which incorporated the most extensive use of express buses, particularly on expressways, showed the highest speeds for both auto trips and bus trips; in spite of a high number of person miles induced by these favourable speeds, both average travel time per trip and total travel time on the system were lower than in other plans.

However, the assumptions used in this plan could not realistically be achieved. As with the other "extreme" models, this particular study was used to illustrate the general effect of variations in transit service levels.

In the recommended, or "balanced" plan, a relatively modest express bus network has been assumed, with the subway system "fed" by 12 express routes on arterial streets and 10 routes on expressways. The inclusion of these expressway routes, compared to a system which contained 23 express routes on arterial streets only, and a further assumption on decreased transfer time between subways and buses, produced favourable result for all modes of transportation. It was particularly significant that the increased travelling speeds made possible by these relatively modest changes benefited auto riders more than transit riders, with the former receiving about ⅔ of the total time saved.

This generally bears out the decisive importance of surface transit in the system. All models tested showed a great proportion of transit riders on the surface system. Even in the "transit-oriented" plans with a very extensive subway system of almost 90 miles, person miles on surface transit exceeded those on subways; in the other models they generally exceeded the volume on subways by more than 50%.

The studies indicated the importance of maintaining a fast, frequent and extensive surface transit system, as both a feeder and supplement to the subways; they also emphasized the need for a road system with a capacity sufficient to accommodate both private vehicles and public transit at acceptable speeds. On several lines, the indicated passenger volumes were higher than can normally be handled by buses, particularly when it is considered that the average hourly volume for a 2-hour peak period, as simulated in the models, may be exceeded by about 25% for the highest hour in that period and by as much as 50% for shorter stretches within that period. It is therefore possible that street car service will have to be maintained on some of the lines, even in 15 or 20 years time. In some cases it will be advisable to consider reserved bus lanes and other traffic regulations favouring transit.

As noted previously, the share of all trips carried by transit has declined over the past 10 years. A substantial further drop would imply a considerably greater amount of travel by automobiles and a greater degree of congestion than shown by the models. A surface transit system not too far inferior to the one assumed here will be required to avoid this. Such a frequent and extended surface transit service is likely to require operating subsidies, and this is one of the main conclusions implicit in the recommended transportation plan.

COMMUTER PARKING FACILITIES

In the studies of the "minimum" transit system, with the subway terminals located at Keele, Eglinton and Woodbine Avenues, it was found that access to these terminals by buses would be seriously impeded by congestion, thereby reducing the attractiveness of the service and the volume of passengers. It was concluded that extension of the lines could generally be justified to points where the peak-hour passenger load averages about 7,000-8,000 persons in the main direction. The ability to move frequent buses into and out of these terminal locations is an important consideration in achieving these volumes.

Even at the extended terminal locations it was found that free access of buses may be impeded by some vehicular congestion on the adjacent roads. This indicates that great care must be exercised in locating high-capacity terminal parking facilities. The traffic congestion generated by such facilities

can serve to seriously slow down the feeder buses, with a resultant increase in travel time and decline in passenger volumes. It is clear that at some point the additional passenger volumes gained through commuter parking could be outweighed by the passenger losses resulting from a slowing down of feeder bus service.

Ideally, it would be desirable to separate out the feeder bus and commuter parking function by assigning them to different stations, but this is difficult to achieve in practice. It is therefore concluded that extensive commuter parking facilities should be provided only at locations where there are good access roads and where large undeveloped land areas are available. This is pretty much the case at three of the four projected terminal locations—Islington/Bloor, Warden/St. Clair, and Wilson Avenue/Wilson Heights Boulevard, but is much less likely at Yonge/Sheppard. Even at these locations, however, it would be desirable to establish commuter parking facilities on a staged basis, so that the actual effect on bus operation can be determined in actual practice before making extensive commitments.

COMMUTER RAILROADS

It was stated in the preliminary plan that commuter rail service could be expected to play an important role in the area beyond the effective range of the mass transportation system, i.e. the area in which average travel times by rapid transit and feeder bus are completely non-competitive with travel time by auto. While the outer sections of the Planning Area fall outside this range, which is generally up to about 10 or 12 miles from the centre, the bulk of the commuter rail "market" is to be found in the communities outside the Planning Area itself, particularly along the lakeshore.

Because there was little data available from outside the Planning Area, few conclusions could be reached about the use of commuter railroads in the transportation system, even though such traffic was simulated in an incomplete fashion on some of the models. Using certain arbitrary assumptions as to fares, it was found that an extensive commuter rail system might attract up to 40,000 or 50,000 peak-hour passengers, and that this would not divert any substantial passenger volume from the transit system. However, it is unlikely that all of the lines could maintain the frequent service which was assumed in order to project these passenger loads, and it has subsequently been determined that available capacity at Union Station would seriously restrict the possibility of providing such service.

Subsequent to these studies, the newly-formed Metropolitan Toronto and Region Transportation Study undertook a detailed investigation of available rail facilities in the area. The results are illustrated on Figure 30, which shows the physical feasibility of establishing rapid transit service on the various rail lines traversing the area. The desirability of providing commuter service on these or other lines, and the capital or operating expenditures required to provide various levels of service, are the subject of continuing study by that agency.

Of particular significance to the Metropolitan transportation plan is the possibility of utilizing the rail right-of-way to Weston for rapid transit service. As noted earlier, this is now being studied in conjunction with the proposed Spadina rapid transit line and Yonge subway extension. Some of the other lines where improved commuter services are feasible, such as the lines to Richmond Hill and Markham, are considered to offer less promise for a high-capacity service, because the greatest part of their potential passengers would originate in areas where adequate transit service will be available and also because such service might tend to stimulate development in remote areas where urban services are not considered desirable, for reasons noted in the Draft Official Plan. The lakeshore main line, on the other hand, clearly serves a promising area for enlarged commuter rail services, and this possibility is being specifically investigated by the Provincial group.

In general, it was found that commuter rail services can play a useful role in filling part of the transportation requirements of the area. This service should focus largely on areas outside the Planning Area, and on the outlying sectors of the Planning Area which lie outside the effective range of an extended transit system. On balance, while the commuter railroads can fulfill a useful function, this role is likely to be quite small in comparison with either the public transit system or private transportation, at least for the period envisaged in the present studies.

Rail Lines considered physically feasible for Rapid Transit
Rail Lines not considered physically feasible for Rapid Transit
Proposed Rapid Transit System

Figure 30—RAIL FEASIBILITY STUDY
(Metropolitan Toronto and Region Transportation Study)

Chapter VII

RECOMMENDED TRANSPORTATION PLAN

The evaluation of the findings of the transportation studies and a detailed review of the individual projects has led to a modification of some of the major proposals and many of the minor features in the preliminary transportation plan. The recommended plan is the product of the balanced approach described in the earlier chapters; it is considered to represent the combination of public and private transportation facilities which is most likely to achieve the objectives outlined in this report and which is most appropriate for this area.

It is not suggested that this plan is in any sense "final." It is probable that the details of many of the individual proposals will be modified considerably before they are actually undertaken, and it is also likely that changing circumstances will lead to substantial changes in the overall transportation system. As noted in this chapter, it is already apparent that certain important questions require further study and reconsideration. Furthermore, a detailed review of the proposed Official Plan, as is envisaged within the next 5 years, will undoubtedly involve a thorough reconsideration of the entire transportation system. Nevertheless the plan presented here is based on the best information available, and is considered to represent the most suitable basis for immediate public action—in the provision of transportation facilities, in the establishment of transportation policies, and in the administration of physical development control coordinated with a comprehensive transportation system.

DESCRIPTION OF PLAN

The recommended transportation plan is shown on Figure 31, and the proposed new facilities are indicated on Figure 32. The plan consists of the following major components:

a) Expressway system

A total expressway system of 197 miles is proposed, of which 105 miles are within Metropolitan Toronto and 92 miles in the remainder of the Planning Area. About 58 miles or 30% of the system, will be under Metropolitan jurisdiction, with the balance under the jurisdiction of the Department of Highways.

All of the expressways originally proposed in the preliminary plan are included, with certain modifications, principally to the Spadina Expressway. The northern end of the Spadina Expressway has been changed to a controlled-access arterial road, and at the southern end the expressway has been extended from its original terminal south of Dupont Street to a point south of Bloor Street. The following expressways are included:

In Metropolitan Toronto		In fringe area	
Queen Elizabeth Way	5 miles	Queen Elizabeth Way	8 miles
Highway 401	26	Highway 401	19
Highway 27	10	Highway 27	2
Highway 400	13	Highway 400	9
Gardiner Expressway	20	Highway 403	9

a) Expressway system—(cont.)

Spadina Expressway	7	Highway 407	36
Don Valley Parkway	13	Highway 404	9
Crosstown Expressway	3		92 miles
Richview Expressway	8		
	105 miles		

With the exception of Highway 401 and Highway 27, which are to have 12 lanes of pavement in major sections, the expressways will have a basic width of 6 lanes. Because of anticipated traffic volumes the physical feasibility of providing 8 lanes on Highway 400 between the Richview Expressway and College Street will be examined, and it is proposed that the Crosstown be restricted to 4 lanes from a point east of Yonge or Bayview so as not to overload the Don Valley Parkway.

Several changes are proposed for the location of expressway interchanges, including the following new interchanges:

Queen Elizabeth Way—Islington/Kipling
Highway 401—McCowans Road
Highway 401—Brock Road
Highway 400—Sheppard Avenue

In addition to the above, it will be necessary to review the location of the interchanges on Highways 27 and 407 and on the Gardiner Expressway in Scarborough.

b) Arterial roads

The plan proposes a total arterial road system of 908 miles, 478 miles in Metropolitan Toronto and 430 miles in the fringe areas. The established concession road grid constitutes the basis of the arterial road system, with future rights-of-way designed to accommodate 6 lanes of pavement (plus provision for turning movements) in the suburban areas and 4 to 6 lanes in the inner areas, depending on the amount and character of existing development.

Most of the new roads which were proposed in the preliminary plan are retained in the recommended plan, with the exception of the Massey Creek Drive, which has been deleted for reasons noted earlier. Some of the new roads originally proposed have been modified considerably, and a number of other roads are proposed in addition. The new roads recommended in the plan are the following:

Avenue Road extension (Highway 401 to Sheppard)	1.0 miles
Mt. Pleasant Road extension (Glen Echo to York Mills)	0.6
Wilson Avenue extension (Albion Road to Rexdale)	1.5
Wilson Avenue extension (Mason Blvd. to Yonge Street)	0.7
Eglinton Avenue extension (Jane Street to Richview Road)	0.8
Islington Avenue extension (Queen Elizabeth Blvd. to Lake Shore Blvd.)	1.4
Lawrence East extension (Highland Creek to Pickering Base Line)	5.5
Finch West extension (Albion Road to Derry Road)	3.5
Queensway extension (Highway 27 to Oakville Town Line)	9.0
Bloor Street extension (Mill Road to Highway 10)	4.0
Rathburn Road (Renforth to Toronto Twp. Base Line)	1.5
Bay Street extension (Davenport Road to Crosstown Expressway)	0.3
Don Mills Road extension (South of Finch Avenue to 14th Avenue)	2.8
	32.6 miles

In addition to the above arterial roads, it is proposed that four new road crossings be established over the central section of Highway 401 at the following locations. While these will not be arterial roads, their provision is considered necessary for the operation of the major road system.

Caledonia Road
Culford Road
Willowdale Avenue
Bannatyne Drive

Figure 31 — RECOMMENDED TRANSPORTATION PLAN

Figure 32—PROPOSED NEW FACILITIES

The plan proposes a number of major road improvements in order to eliminate existing jogs or other impediments to effective traffic flow. These are generally to be found along the base survey lines, such as Steeles Avenue, where existing jogs may run up to 1,000 feet, and at major valleys, such as the Rouge River at Finch Avenue and Sheppard Avenue. A long-term program for the improvement of these road connections is essential for the proper operation of the road system. It is also proposed that all existing rail crossings at grade be eliminated, in accordance with priority principles established in the Official Plan.

c) Public transit system

The plan proposes a rapid transit system of 30½ miles, compared to 37 miles in the preliminary plan. The principal changes are the deletion of the Queen-Greenwood subway (with consideration of an intermediate transit facility), and the extension of the Bloor-Danforth subway to Islington Avenue on the west and to Warden/St. Clair on the east. The following rapid transit lines are proposed:

Yonge Subway	8½ miles
Bloor-Danforth Subway	14
University Subway	2
Spadina Rapid Transit line	6
	30½ miles

The successful operation of the public transit system will depend on the provision of an adequate surface transit system. The establishment of specific surface routes requires detailed consideration by the Toronto Transit Commission and cannot be stipulated in the transportation plan, but on the basis of these studies it is recommended that serious consideration be given to the establishment of express bus routes on the expressways and arterial roads leading to the subway terminals.

d) Commuter railways

For reasons noted earlier, no commuter rail services are proposed in the transportation plan, though it is expected that specific proposals may be forthcoming from the studies currently being conducted by the Metropolitan Toronto and Region Transportation Study.

e) Commuter parking

For the immediate future, it is proposed that limited commuter parking lots be established at the Islington, Warden/St. Clair, and Wilson Avenue terminals of the rapid transit system. While sufficient land should be reserved or acquired for the possible establishment of extensive parking facilities at these locations, their development should be limited in the first instance to about 500 or 1,000 cars. This will make it possible to assess the effect of these lots on the movement of buses into and out of the terminals, and on general traffic movements in the area, as well as to assess the economics of their operation.

PERFORMANCE OF THE RECOMMENDED PLAN

The projected 1980 "loadings" for the expressway system are shown in Figure 33, and for the rapid transit system in Figure 34. It may be seen, as indicated earlier, that almost every link in the expressway system is expected to function at or near its capacity (in some cases above). For the rapid transit system, the passenger volumes are generally expected to be higher on the Bloor-Danforth line than on the Yonge and Spadina lines, particularly in the outer sections of the system. Projected terminal loads will run well over 10,000 passengers per hour on the Bloor-Danforth line, and will exceed 15,000 close to the terminal points.*

On the Yonge and Spadina line, terminal volumes will be considerably lower than this, approaching 8,000 passengers per hour on the former line and not much more than 5,000 on the latter. However,

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*The subway passenger volumes shown on Figure 34 represent 125% of the average hour in the 2-hour peak period. This is equivalent to the *actual* peak hour in the 2-hour period, which generally shows a sharp fluctuation (loads during the peak quarter-hour may run at a rate as high as 150% of the 2-hour average). The fluctuation is not nearly as great on the road system, running up to about 110% for the peak hour in the 2-hour peak period, and the loadings shown on Figure 33 have therefore not been adjusted and represent the *average* hour in the peak period.

Figure 33—1980 EXPRESSWAY PEAK-HOUR VEHICLE VOLUMES
(Recommended Transportation Plan)

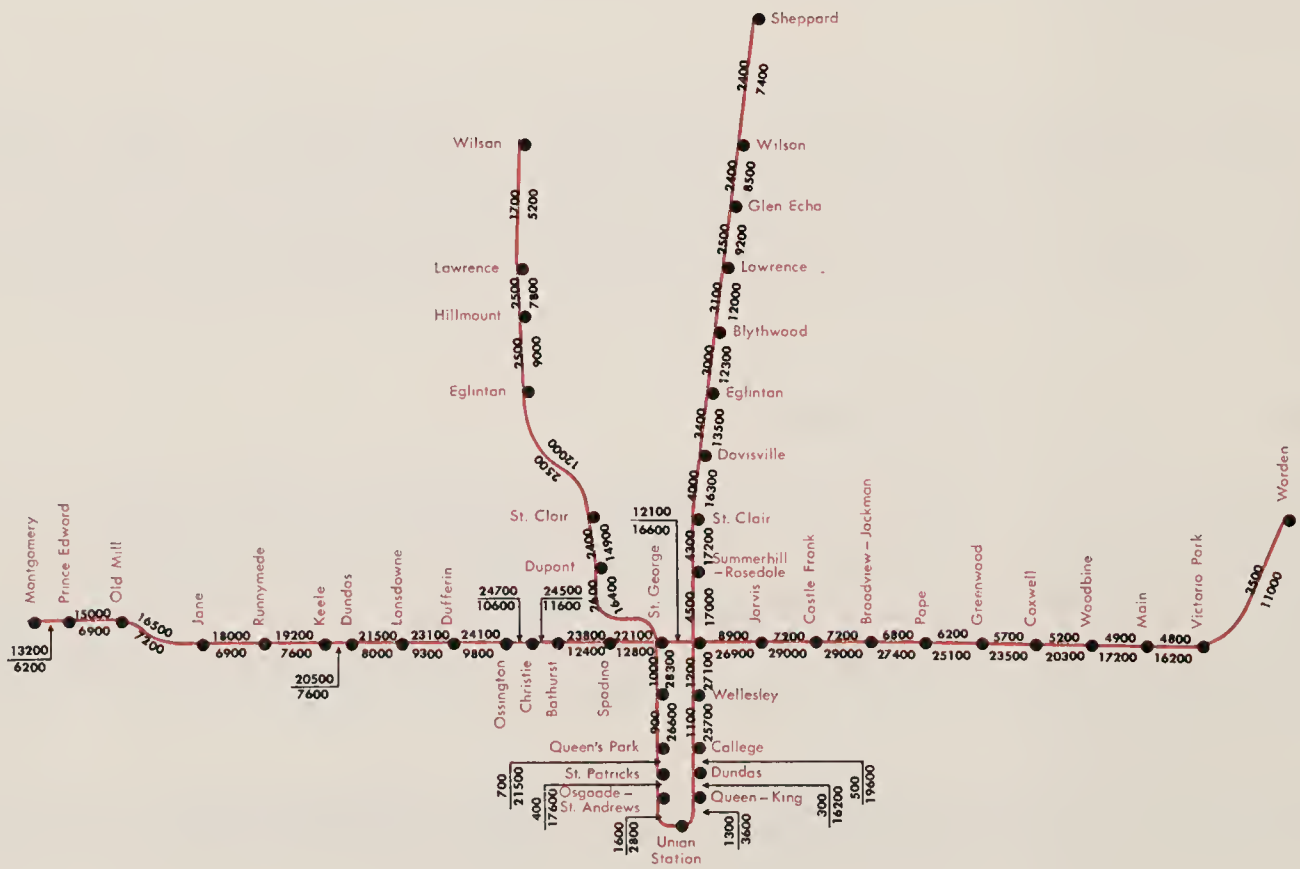


Figure 34—1980 RAPID TRANSIT PEAK-HOUR PASSENGER VOLUMES
(Recommended Transportation Plan)

on the Spadina line the projected loads increase rather decisively south of Lawrence, and the availability of right-of-way in the expressway median and the location of the future transit yards north of Wilson Avenue indicate that the line should be established in its entirety. However, as discussed earlier, the entire question of Yonge and Spadina and the degree of service to be provided on each is to be the subject of a further study.

With respect to the system generally, it was noted earlier that a "balanced" transportation system (essentially similar to the recommended plan), would produce better results than either an extreme "auto-oriented" or an extreme "transit-oriented" system. A comparison of the anticipated performance of this system with present conditions is provided in summary form in Table 8, and is illustrated in Figure 35. This comparison is with respect to the estimated transportation conditions as they existed in 1961/62 and indicates that if the proposed system is established the service it will provide will be superior in almost every respect to that in effect today.

The projected population increase of about 55% by 1980 is expected to produce an increase of nearly 90% in the number of peak-hour trips. Of this, transit trips are expected to increase by about 50%, and vehicle trips by more than 100%. Total travel mileage for all persons is expected to increase by about 150%. But because of an expected increase of about 75% in average speed, total travel time will go up by only 42%, or less than ⅓ the increase in travel mileage.

This is perhaps the most encouraging result of the projected traffic analysis—that despite an increase of ⅓ in average trip length (from 7½ to 10 miles), the average time spent on each trip will not increase but will drop by about 10 minutes, or 25%, and that the duration of the average trip will not exceed 30 minutes. While average speed will increase on both expressways and arterial roads, and for surface transit vehicles as well, this does not imply that speed will be substantially improved on presently congested roads, but rather that a far greater proportion of future travel will take place on uncongested roads and expressways, and, in the case of transit, on subways and express buses.

The increasing proportion of travel on expressways—which will nearly double, to 40% of all vehicle travel—may be seen clearly in Figure 36, which compares the projected traffic flow in 1980 with the current situation. While subways will also carry about 40% of transit trips, many of these will also use surface buses, and the greatest growth in transit patronage will occur in the outlying areas.

In 1980, as in 1961, automobile travel is expected to be almost twice as fast, on the average, as transit travel. However this relationship does not hold true for all sections of the area. The area which can be reached from the centre of the city in a 30-minute drive during the evening rush hour can generally also be reached by transit in about the same time. However the areas within 40 or 50 minutes driving time can be reached by transit only by a much longer ride.

It is expected that the areas of severe congestion will shift considerably, as shown in Figure 37*. It may be seen that while congestion is very widespread today, by 1980 such congestion will be found mainly in the more central areas. Total congestion will be reduced considerably, and severe congestion will be cut by more than half, but it will still present a serious problem in the inner area. The projected congestion is summarized in Table 9.

The share of transit is expected to drop from over 40% of all rush hour trips to about ⅓, but the actual number of transit passengers will increase by 50%. However because transit trips will be longer (by about 2 miles on the average) the number of passenger miles will more than double. The need to supply such a greatly extended service will require substantial operating expenditures. However operating costs per person-trip are strongly influenced by the average trip duration, which is expected to decrease by nearly 20%. This, together with an increased load factor on the subways, may at least partially offset the deterioration of the load factor on surface transit which must be expected with its extension into areas of lower density.

Transit will continue to account for the majority of all rush-hour trips in the more central areas, and the area within which transit carries at least ⅕ of all trips will be considerably larger in 1980 than it is today, as shown in Figure 38. Nevertheless, transit will still be of relatively little importance in the outlying areas; this is simply a reflection of the relative time advantage noted above for automobile travel over transit travel from these areas.

*See footnote page 43 for definition of "medium" and "heavy" congestion.

TABLE 8—COMPARISON OF 1961 AND 1980 TRANSPORTATION SYSTEMS

	1961*	1980**	Change 1961 to 1980
Facilities* **			
1. Miles of expressway	67 miles	175 miles	+161%
2. Miles of arterial road (lane miles)	2,500 miles	4,000 miles	+60%
3. Miles of rapid transit	4½ miles	29 miles	+545%
Total system performance			
4. Total travel time	191,000 hours	273,000 hours	+43%
5. Total travel mileage (person-miles)	2,142,000 miles	5,348,000 miles	+149%
6. Total vehicle mileage	1,163,000 miles	2,965,000 miles	+155%
Trips			
7. Transit usage (% of total person trips)	41.2%	32.5%	−21%
8. Total person trips	290,000	542,000	+87%
9. Vehicle trips	130,000	267,000	+105%
10. Transit trips	118,000	176,000	+49%
Average trip length			
11. All trips	7.4 miles	9.9 miles	+34%
12. Vehicle trips	9.0 miles	11.1 miles	+22%
13. Transit trips	5.2 miles	7.3 miles	+40%
Average trip time			
14. All trips	39.6 min.	30.0 min.	−24%
15. Vehicle trips	36.6 min.	26.4 min.	−28%
16. Transit trips	43.8 min.	35.2 min.	−20%
Average trip speed			
17. All trips	11.2 m.p.h.	19.6 m.p.h.	+75%
18. Vehicle trips	14.6 m.p.h.	24.0 m.p.h.	+64%
19. Transit trips	7.1 m.p.h.	12.4 m.p.h.	+75%
Average vehicle speed			
20. On expressways	31.6 m.p.h.	34.1 m.p.h.	+8%
21. On arterial roads	12.7 m.p.h.	20.1 m.p.h.	+58%
22. Surface transit ****	6.8 m.p.h.	9.1 m.p.h.	+34%
Utilization of major facilities			
23. Vehicle miles on expressways (% of total vehicle miles)	22%	40%	+82%
24. Transit miles on rapid transit (% of total transit miles)	12%	39%	+225%
System efficiency			
25. Vehicle miles per expressway mile	3,800	6,700	+76%
26. Passenger miles per rapid transit mile	17,200	17,900	+4%

*Based on 1961 simulation study to test validity of Traffic Prediction Model

**Recommended transportation plan

***"Computed" mileage

****Excluding expressway buses

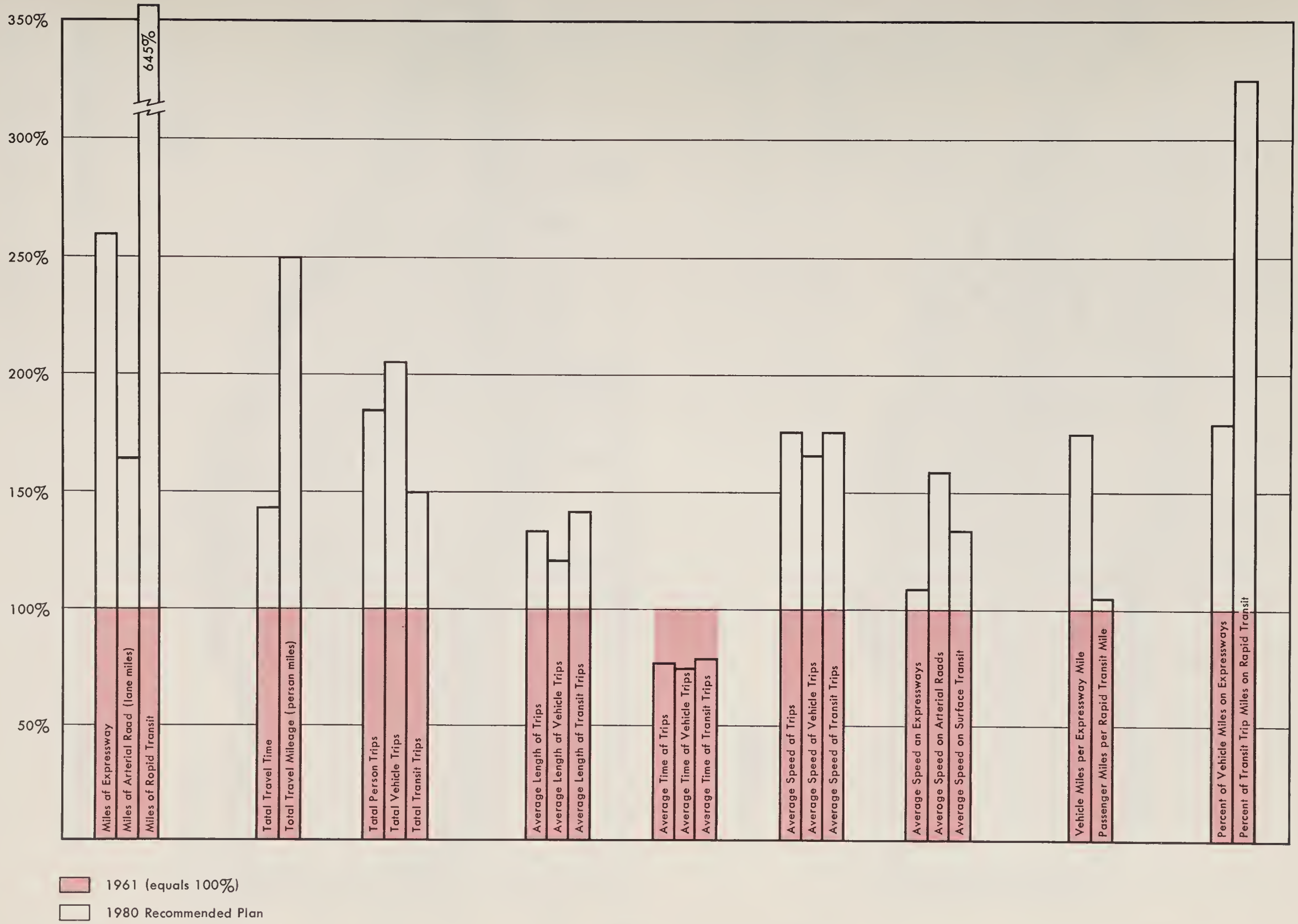


Figure 35—COMPARISON OF 1961 AND 1980 RECOMMENDED PLAN

1961 Vehicle Volumes

1980 Vehicle Volumes
(Recommended Transportation Plan)

Figure 36—PEAK HOUR TRAFFIC FLOW

TABLE 9—CONGESTED STREETS, 1961 and 1980

	1961	1980
Medium congestion	61 miles	72 miles
Heavy congestion	68	32
	129 miles	104 miles

Perhaps the best measure of the adequacy of the proposed transportation system lies in the degree of accessibility which it will provide throughout the area, and for the central area in particular. For this purpose, the distances which could be reached within 30-minutes driving time and 40-minutes transit time from a number of different locations have been determined, and the results shown in Figure 39 and 40.

Figure 39 shows the relative accessibility to three selected *inner* locations, each of which is well served by transit. It may be seen that the area reached in a 40-minute transit ride is generally as great as, or will even exceed, the area reached in a 30-minute auto ride. On the other hand, for the four *outer* locations shown in Figure 40, a 30-minute auto trip will generally reach much further than a 40-minute transit trip.

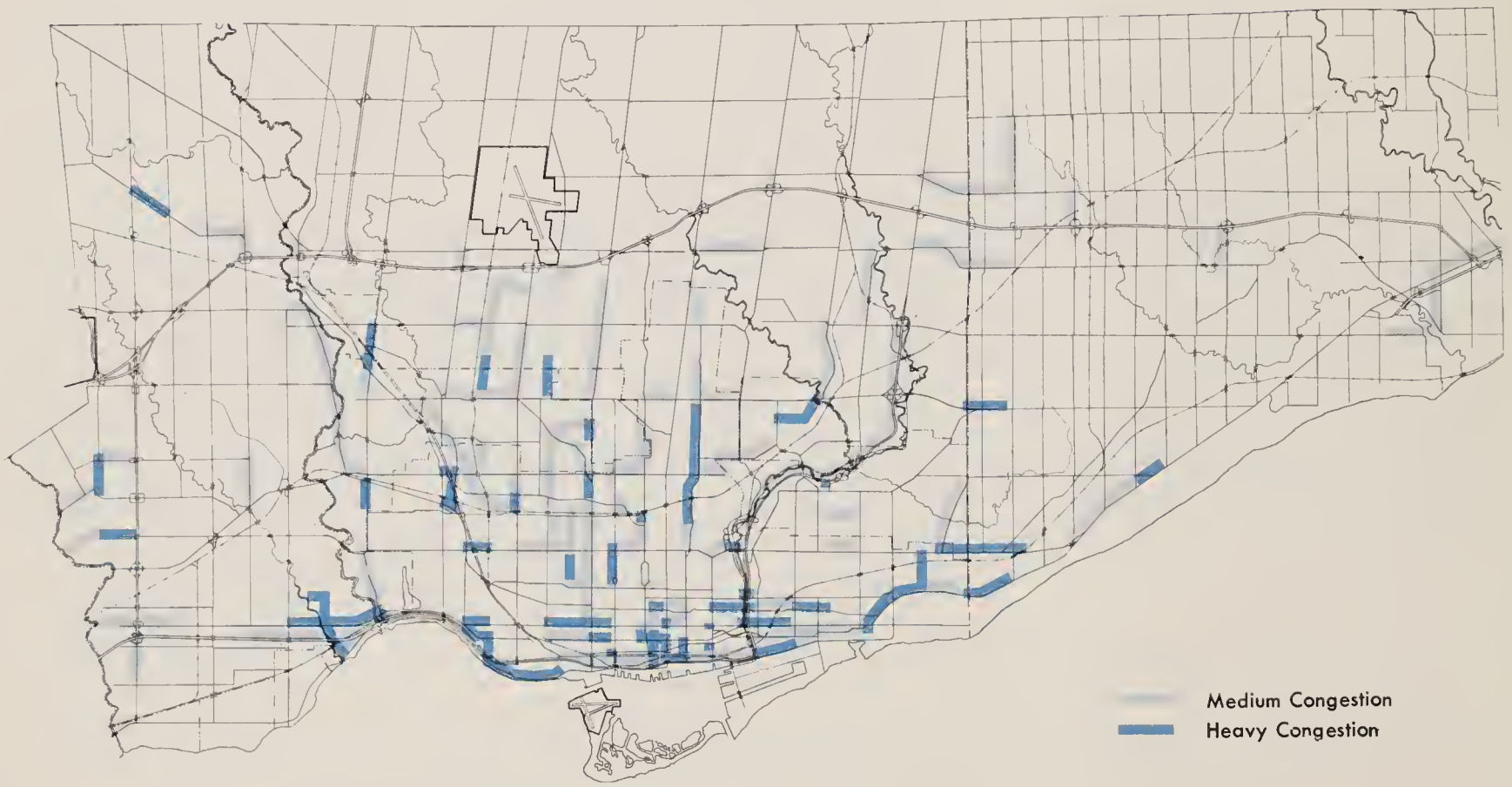
Despite this, almost all of the outlying locations will be within a reasonable trip time of the central employment area. Table 10 gives a tabulation of the number of persons who will be living within a half-hour of the central business district, whether by car or transit. It may be seen that the proportion of the population within ready automobile access of downtown will increase from ⅓ to about ½, and that for transit access the proportion will more than double.

TABLE 10—POPULATION WITHIN 30 MINUTES TRAVEL TIME OF CENTRAL BUSINESS DISTRICT

	1961		1980	
	Population	Percent of Metro Population	Population	Percent of Metro Population
Within 30-minute driving time	542,000	33%	1,115,000	49%
Within 30-minute transit time	336,000	21%	1,036,000	45%

It has already been noted that both the expressway and the rapid transit system would receive considerably greater usage than at present, expressed as a percentage of total automobile and transit travel. With respect to the efficiency of the major facilities, the recommended transportation plan also yields favourable results. The loading factor on expressways (vehicle miles per expressway mile) will increase very substantially—by more than ¾. While it was noted earlier that expressways will always be operating at full capacity, this sizeable increase will result from the fact that two of the expressways, Highway 401 and Highway 27, will be increased from 6 to 12 lanes, with a consequent increase in capacity per mile. With respect to rapid transit, the loading factor (passenger miles per subway mile) will increase slightly; as pointed out earlier, it is noteworthy that this degree of efficiency will be attained despite the fact that total subway mileage will increase more than six-fold.

1961



1980

Figure 37—COMPARISON OF 1961 AND 1980 CONGESTION

1961

1980

Figure 38—TRANSIT TRIPS AS PERCENT OF PEAK-HOUR TRIPS

Dundos — Roncesvolles

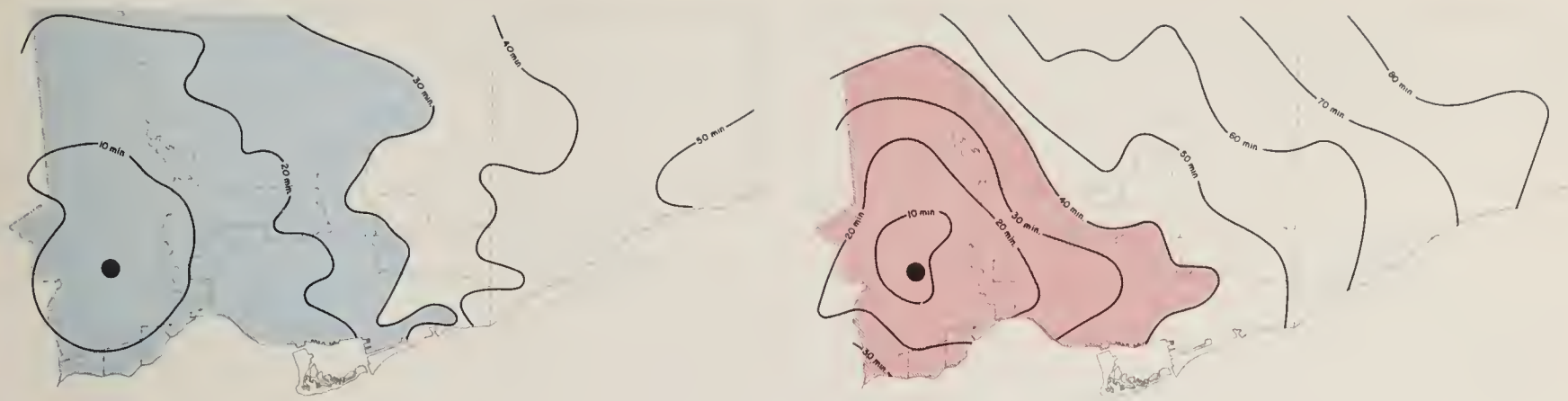
Eglinton — Mount Pleasant

Danforth — Woodbine

Auto Travel Time

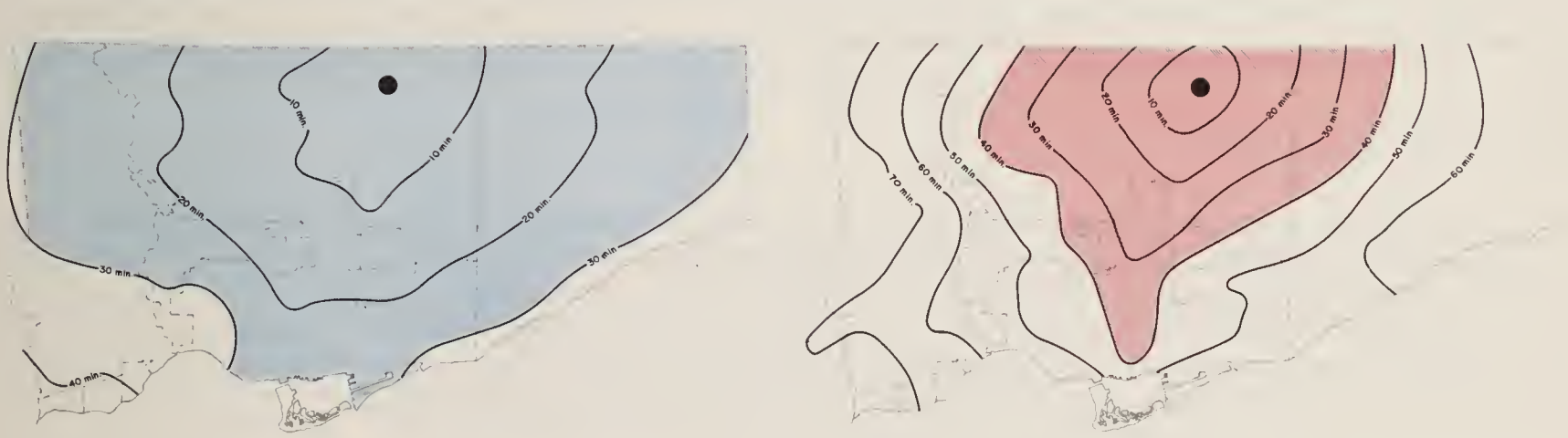
Transit Travel Time

Figure 39—COMPARATIVE TRAVEL TIMES—1980
(Selected Inner Locations)

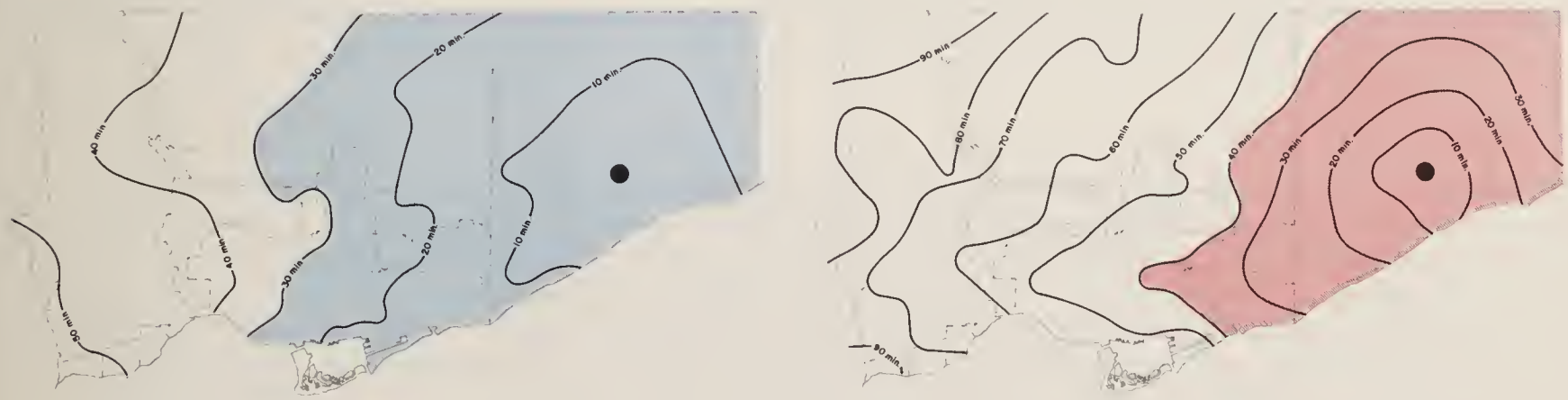


Kipling — Bloor

Rexdale — Martin Grove



Finch — Bayview



Lawrence — Morkham

Auto Travel Time

Transit Travel Time

Figure 40—COMPARATIVE TRAVEL TIMES —1980
(Selected Outer Locations)

Figure 41—CHRONIC CONGESTION

OUTSTANDING QUESTIONS

The general results described above show fairly conclusively that the proposed transportation system will achieve satisfactory results with respect to the general objectives of the transportation plan—e.g. travel speed, mobility, accessibility, and the effective utilization of major facilities. While transit's share of total travel is expected to decline, the projected level is considered to be about as satisfactory as can reasonably be achieved in the light of continued decentralization and expected increases in car ownership and personal income. Certain major questions still remain outstanding, however, and it will be necessary to give them careful consideration over the next period of time.

Most of these questions have already been touched on in previous sections, and they are briefly summarized here.

a) Congestion

It was noted (in Figure 37) that while there will be general improvement in traffic conditions in the intermediate and outer areas, the inner areas may expect increased congestion, perhaps as a result of easier access resulting from improved facilities in the other areas. It is evident that the Metropolitan and local authorities should undertake a comprehensive review of the transportation system in the central area, with particular attention to the improvements which are required to accommodate the great increase in private and public redevelopment and also to the opportunities which such redevelopment presents for traffic improvements. The current establishment of Metropolitan centralized computer traffic control will make it possible to secure maximum advantage from one-way streets and other regulatory measures, and these should be pursued vigorously. It is particularly important to establish a suitable plan for distributing traffic from the inner expressway ring.

In addition to inner area congestion, there are certain areas of chronic congestion which will require continued attention. These are shown in Figure 41, which indicates general areas which were severely congested in *all* of the various plans tested. The fact that these areas showed up as congested

irrespective of the widely different assumptions and facilities projected in the different plans would appear to indicate that these are generally serious problem areas. It may be noted that many of the areas concerned are at locations where traffic is funnelling from several directions into one or two concentrated points, while others appear to represent localized problem areas. In any event, further study should be made of these areas in an effort to determine suitable means of relieving the problems.

b) Intermediate transit facilities

It was noted that consideration should be given to the establishment of a transit facility with an "intermediate" capacity along Queen Street, and it is possible that there are other locations where such a facility merits consideration. It is one of the principal weaknesses of the present transit plans that they only provide for extreme demands—subway facilities capable of carrying 40,000 persons an hour and buses with a maximum capacity of up to 5,000 passengers an hour. The suggested "subway-surface street car," with a capacity of up to 15,000 per hour, appears well suited for Queen Street, and there will also be at least some transit lines where continued use of street cars (with a capacity of up to 10,000 per hour) is indicated over the period of this plan.

While previous studies have indicated that there is no important role in the metropolitan transportation system for such intermediate capacity facilities as monorail (except possibly for specialized lines providing a high volume point-to-point service, such as the C.N.E.), careful study should be given both to the immediate question of a suitable intermediate facility for Queen Street and the general question of providing such facilities in other locations where they might be warranted by future demand.

c) Extensions to rapid transit system

While there is no doubt that some form of rapid transit facility should be provided both on north Yonge Street and the Spadina Expressway, the exact character of these two facilities, and their timing, should be given further study, together with the related question of a possible transit line along the railway right-of-way to Weston. The various considerations involved in this question were discussed in the report, and the required study is now being initiated.

d) Extensions to expressway system

Further extensions to the expressway system which will require consideration at a future date include the possible "west-end" loop, involving a direct connection between Highway 400 and the Gardiner Expressway in the vicinity of Keele/Parkside, and an eastern extension of Highway 407 through Pickering Township. A possible "east-end" loop may also be required at some future date, but this may take the form of an arterial road connection between the Don Valley Parkway and the Gardiner Expressway in the vicinity of the Massey Creek Valley, rather than an outright expressway facility.

As indicated earlier, these are considered to be the only prospective additions to the expressway system which may be warranted by the future development of the area within the limits established by the proposed Official Plan. It should also be noted that the alignments of the proposed expressways may be subject to some changes as more detailed studies are conducted and as circumstances change.

e) Cost of recommended plan

The cost of providing the proposed transportation system is estimated as being at least $1 billion. For the Metropolitan Corporation alone, the cost of the proposed projects (including remaining costs for work already underway) will run about $800 million, of which about 35% would be for rapid transit facilities, 40% for expressways, and 25% for new arterial roads and widening or improving existing arterial roads. Expenditures on Provincial highways included in the plan will obviously be very high, and in addition there will be local expenditures for arterial road facilities in the fringe municipalities.

The cost estimate does not include the likely subsidies which will be required for the extensive surface transit operation on which the entire transportation system will be largely dependent. Only about $350 million, or less than half of the prospective Metropolitan capital expenditure, is included in the current Capital Works Program ending in 1973. To provide the proposed transportation system by 1980 under current financing arrangements would therefore require a considerable increase in the rate of Metropolitan expenditures for transportation purposes.

In the light of the Metropolitan Corporation's other capital obligations, and with the strong possibility of increased requirements in the field of redevelopment and renewal, it would appear that the present resources may be inadequate for the contemplated transportation program. Nevertheless, the results of the present studies indicate quite conclusively that the projected program is essential to accommodate the anticipated growth and development of the area. Either type of extreme alternative program—concentrating exclusively on expressways or transit—might conceivably be less costly, but the resultant congestion and delay makes such an approach unacceptable, and the hidden or uncalculable costs might far exceed the cost of providing the balanced transportation system recommended here.

It is therefore evident that the entire question of securing adequate financial resources for the projected transportation program represents the most important question which remains outstanding. This matter is to be dealt with by the Metropolitan Toronto and Region Transportation Study in its assessment of transportation requirements and financing for the larger region from Oshawa to Guelph and from Hamilton to Barrie, and can perhaps wait until that study has been completed. There is little doubt however that the financial implications of the recommended transportation plan will require urgent attention in the near future.

Appendix A

BRIEF DESCRIPTION OF THE TRAFFIC PREDICTION PROCEDURE

SCIENTIFIC APPROACH TO TRANSPORTATION PLANNING

During the past few years a great deal of research has been undertaken in Metropolitan Toronto and other large urban areas to develop a scientific procedure for the planning of increasingly complex and costly transportation systems comprising various combinations of road, transit and rail facilities.

This procedure, which requires the use of an electronic computer to undertake the great number of calculations involved, is a complex, highly flexible planning tool, the basic component of which has been named the Traffic Prediction Model.

The use of computers to simulate future traffic behaviour makes possible far more detailed predictions of the results of a number of alternatives than can be made by any other method, and thereby increases the probability that the decisions based on these predictions will be correct. With a long-term investment approaching $1 billion an increase in probability of as little as 1% can result in saved costs or increased benefits of the magnitude of $10 million. The justification for the expense in time and money required to construct these computer models rests in this increased probability of true predictions, not in any mysterious claim to infallibility.

THE TRAFFIC PREDICTION MODEL

The Traffic Prediction Model performs a series of sequential operations (Figure 1A) in order to estimate the travel demand of the area's inhabitants as affected by those factors known to motivate their travel decisions. These operations determine the number of person-trips to be considered in the study area, the origin and destination of these trips and their choice of travel mode. An operation is also included by which travel time is allowed to affect the selection of the travel route as well as to influence the ultimate choice of travel mode and trip distribution. These decisions are implicit in the traffic pattern of any urban area where delay caused by traffic congestion will induce travellers to seek alternate less congested routes and to choose other means of travel. Conversely, the existence of a free-flowing direct route between two areas will draw traffic from other more crowded routes and will even attract new trips between the two areas.

Having projected existing land use patterns to their probable figuration at a given future year, the Traffic Prediction Model is used to indicate the extent and manner in which alternative transportation systems would be utilized under the stated conditions.

TYPE AND PRESENTATION OF OUTPUT DATA

The figures produced by the study procedure give a large volume of information on the results of any set of transportation facilities and operating policies. They indicate how many hours and how many miles people will travel on a given system, both as a total and as an average per trip, and the resultant average speed. They give the same data separately for each mode, public and private transportation, and for each sub-mode; expressways and arterial roads for private vehicles and surface transit, subways, express buses and commuter railroads for public transportation.

For each study the model produces the number of passengers and vehicles on every link of every facility, the degree of congestion and the resultant travelling speeds on each link of each expressway and each arterial road. Further analysis can show the accessibility of any zone from all other zones, the area served by any given facility, and other significant data.

For analytical purposes and simple appreciation, this data is presented in tables, graphs and other methods of illustration. By comparing the data obtained from studies of different transportation systems or variations in individual facilities it is possible to determine the system most suited to the land use and traffic demand of the area.

LIMITATIONS OF THE SIMULATION PROCEDURE

The reliability of the results of the simulation procedure is governed by the soundness of the input data used and their description for assimilation in the computer. The possible sources of imperfection fall into four categories:

(1) Stability of person travel characteristics

All mathematical formulas and empirical relationships used to simulate average travel behaviour characteristics have been based on the results of factual surveys. These formulas have been subjected to a series of tests to ensure statistical reliability in relation to the functions they perform. In the absence of new surveys and statistical analysis which would indicate the stability of the formulas originally developed, it has been assumed that the basic travel characteristics of the survey year 1956 will be the same for the projection year 1980. A new home interview survey was conducted in 1964 and will provide the basis for further transportation studies.

(2) Conformity with the 1980 Land Use Plan

In all models land use has been kept constant, although it is possible that changes in the transportation system may generate strong pressures toward changes in land use, which changes can in turn generate different traffic patterns. The Draft Official Plan has, of course, attempted to anticipate the probable effect of the transportation facilities included in that plan. Insofar as facilities finally adopted differ from those in the Draft Official Plan, it can be expected that land uses and densities may differ from those presented in the plan. Moreover, other changes may occur for a variety of reasons, which cannot be determined at this time.

(3) Predictability of significant variables that influence travel

In addition to the anticipated land use activities the traffic prediction procedure uses certain essential variables which are difficult to predict because they are influenced by many external factors. These include car ownership and distribution, transit fares, the supply and cost of parking and the distribution of per capita income. The results of each study are therefore influenced by the ultimate validity of the values assumed for these variables.

(4) Simplification of land use and transportation plan

Although it may be physically possible, it would not be economically feasible to describe in complete detail the transportation system and the type and the extent of the total land uses and activity of the area under study. The distribution of population, employment, dwellings, residential acreage etc. is of necessity described in a relatively coarse array of zones of various sizes. Similarly, the transportation system is generally described by a system of "links" to represent the capacities and operating conditions of the various types of facility contained in the plan under study. Figure 2A illustrates the transportation and zone systems used in the simulation procedure.

VALIDATION OF SIMULATION PROCEDURE

The Traffic Prediction Model developed by the Metropolitan Toronto Planning Board and the Traffic Research Corporation has been tested in full-scale studies of the Metropolitan area by comparing

the observed and simulated traffic volumes for the 1956 survey year, and also the year 1961.

In brief, the test studies involved the use of the simulation procedure to reproduce traffic patterns and facility volumes which were compared to those actually reported for the study years. Comparison of the simulated and observed peak period trip generation, trip distribution, cordon line traffic, mode of travel and usage of facilities indicated the closeness with which the simulation procedure could be expected to predict similar data for a given projection year.

The tests indicated that considerable prediction accuracy is achieved for high volume facilities, with lesser accuracy for lower-type facilities. There are a number of reasons why this is so. Expressways and rapid transit facilities are far more efficient in their operation because many frictions that are most evident on other facilities are avoided. Consequently, their operating characteristics and use are more readily predictable than on less efficient facilities. Also, because of their major significance, these trunk facilities are described in greater detail than lesser facilities.

As a result of these test studies the predictable accuracy of the study procedure was found to be adequate for its intended purpose and for the series of studies subsequently undertaken in the evaluation of the Preliminary Transportation Plan.

MARGIN OF ERROR

As is evident from the foregoing, there remains still a considerable area of uncertainty.

This is to be expected. It may be recalled that all sources of uncertainty enumerated above are present also in every other method of estimating future traffic, together with many sources of error which have been eliminated by the use of explicit and exact mathematical simulation models. The margin of error has been substantially reduced by this study.

SCHEMATIC OPERATION OF THE TRAFFIC PREDICTION MODEL PROCEDURE

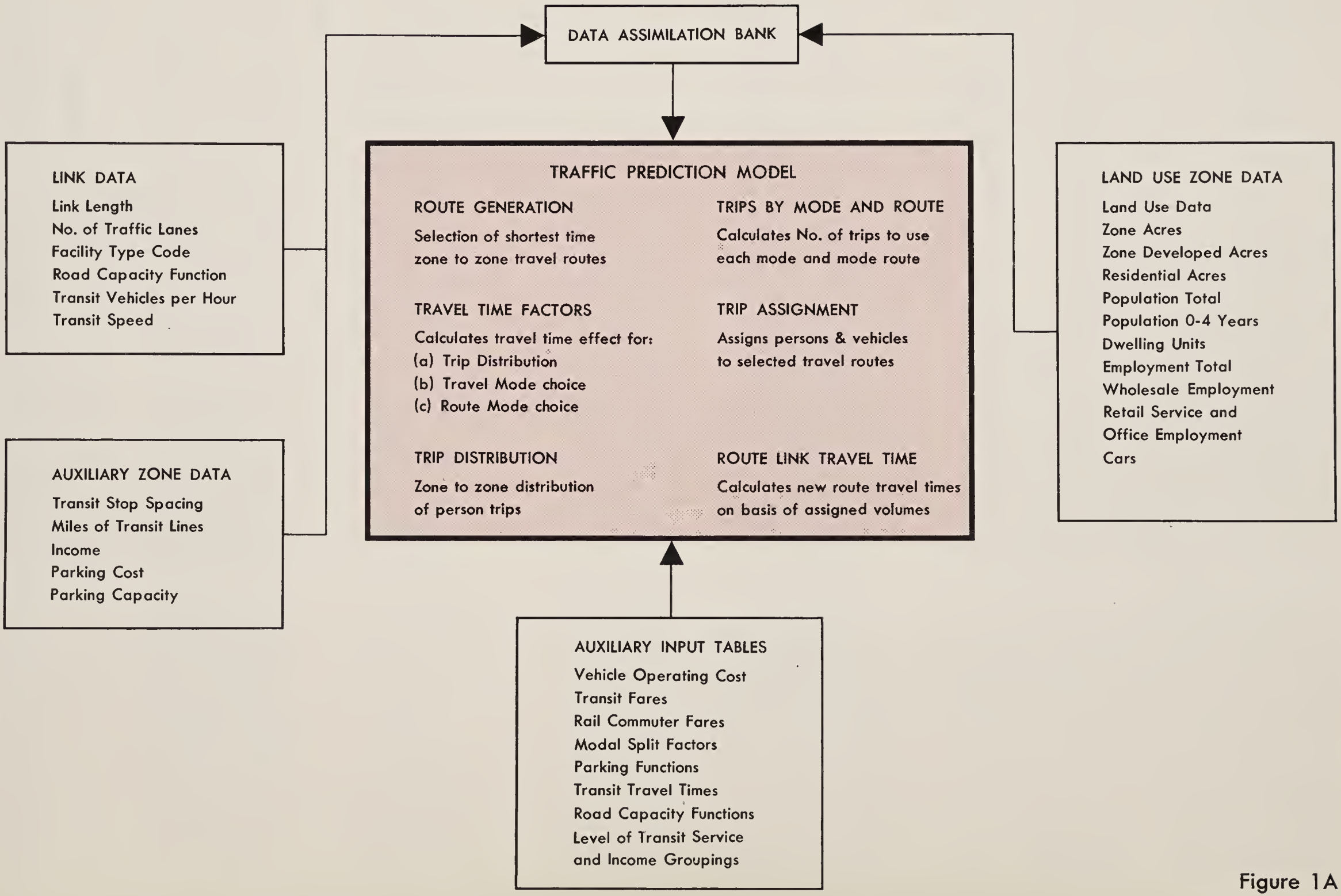


Figure 1A

Figure 2A — TRANSPORTATION AND ZONE SYSTEMS

Appendix B

DESCRIPTION OF PLAN STUDIES

The varying assumptions made for each study plan model in each of the four study groups are presented in Tables 1B to 4B. The main points may be summarized as follows:

The "A" series, comprising five study plans, all use 398 data zones. These studies were undertaken to evaluate the preliminary transportation plan. Plans A-1 and A-2 incorporate all the transportation facilities included in the preliminary plan; the latter assumes no operation of commuter railroads, while Plan A-1 assumes that commuter railroad service will be operated at extremely favourable conditions. A comparison between the two plan studies gives the upper limit of the number of rail commuters who could be attracted within the Planning Area and their maximum impact on the traffic volumes on the roads and on transit. Plans A-3, A-5 and A-4 omit, respectively, the Spadina subway, the Spadina expressway, and both. The Study "A" series base plan is shown in Figure 3A.

The "B" series, designed to study the significance of changing various operational factors, used the same income assumptions as the "A" group but employed only 133 data zones. It included the expressways and the rapid transit lines shown in the preliminary Transportation Plan, with the exception of the Queen Street subway line, and assumed commuter services in all plans (Figure 4A).

The 6 plans of the "C" series, using 133 data zones, used a different income level to that of studies "A" and "B". Their results are therefore not strictly comparable with those of the "A" and "B" series. The primary purpose of these six plans was to test the relative impact of investments in expressways and in rapid transit lines, respectively, by making the extreme assumptions that all future investments would be made exclusively either in the one or in the other type of facility. Facilities built or definitely committed were included in all models.

Plans C-1, C-2 and C-3 ((Figure 5A) assume that a complete system of expressways and arterials will be available, but no subways except the existing Yonge Line and the committed University-Bloor-Danforth Line from Keele to Woodbine. Plan C-1 included expressway buses and Plan C-2 excluded expressway buses and included rail commuter services.

Plans C-4 and C-5 (Figure 6A) assumed only the existing and committed expressways but a very extensive system of rapid transit lines with a total length of 88 miles. Plan C-5 also included rail commuter trains at an average operating speed of 33 miles per hour, on 116 miles of line within the Planning Area, under the same conditions as under Plan C-2, as well as express buses on 60 miles of expressways.

Because of more widely spaced stations on the outer sections of these lines, the average speed on all rapid transit lines was raised to 22 miles from 20 miles per hour. In addition, it was assumed that the rapid transit system will be supplemented by a number of express buses on reserved lanes of expressways operating at speeds of 35 miles per hour. The number of lanes available for other vehicles on these expressways was consequently reduced by one lane. Finally, it was assumed that it will be possible, by traffic regulations favouring transit over other vehicles, to increase the ratio of surface bus speeds to vehicle speeds from the present level of 12:17 to 14:17 miles per hour.

Plan C-6 was designed on the basis of results obtained from the Plan "C" series. (Figure 7A). It was, in effect, the first adjustment of the preliminary transportation plan.

Finally, the "D" series, comprising 4 plans, was designed to test the recommended transportation plan. To improve accuracy, the number of data zones was increased to 234. This series also assumed a

45% increase in average per capita income which was considered to be more realistic than previous income level assumptions. Plan D-2 is a variant of D-1, with no change in trip distribution ("frozen" distribution) but with improved feeder services to subway stations by means of express buses on selected arterial roads and expressways. (Figures 8A). Plan D-3 was varied from D-1 to determine the increased transit riding on the subway system if the transfer time from subway to bus was reduced. In Plan D-4 average per capita income was lowered to that of the Plan "C" series to enable comparison between the extreme plans and the recommended plan.

TABLE 1B — DESCRIPTION OF INPUT DATA — GROUP 'A' STUDIES

FIXED INPUT DATA GENERALLY ASSUMED IN ALL GROUP 'A' STUDIES			INPUT DATA	VARIATIONS FROM BASE (A2) ASSUMED IN STUDIES A1 TO A5				
				A1	A2 (Base Study)	A3	A4	A5
1980 Draft Official Plan. Traffic Zones 398			Land Use					
Private Vehicles	Subway	Surface local transit	Travel Modes	Rail Commuter added		Spadina Subway excluded	Spadina Subway and Expressway excluded	Spadina Expressway excluded
Expressways and Rapid Transit facilities contained in the 1980 Draft Official Plan unless varied as shown in Figure A3			Transportation Facilities	6 radiating rail lines				
3 zone fares: (1956 base) 1 zone 10¢; 2 zones 18¢; 3 zones 23¢			Transit Fares					
			Rail Commuter Fares	5 miles—25¢ 5-8 miles—30¢ then 3¢/mile				
1.65¢ per minute. Based on an average travel speed of 20 m.p.h.			Vehicle Operating Costs					
From $0.50 to $1.50 for 8 hours No limitation of spaces			Central Area Vehicle Parking					
			Fringe Vehicle Parking	Unlimited Capacity No charge				
Subway at 2 minute headways. Based on 1956 level of service in relation to population density			Level of Transit Service					
Subway speed 20 m.p.h. Surface speed proportional to car speed 12:17 m.p.h.			Transit Speeds					
			Rail Commuter Speed	Average Speed 38 m.p.h.				
Overall increase in zone incomes of 12% from 1956			Income Per Capita					
6 levels of transit service (minutes) 4-8-12-18-22-30 5 income groups $2050, 2400, 2640, 2900, 5000			Modal Split Classification					

TABLE 2 B — DESCRIPTION OF INPUT DATA — GROUP 'B' STUDIES

FIXED INPUT DATA GENERALLY ASSUMED IN ALL GROUP 'B' STUDIES	INPUT DATA	VARIATIONS FROM BASE ASSUMED IN STUDIES 1 TO 10									
		1	2	3	4	5	6	7	8	9	10
1980 Draft Official Plan. Traffic Zones 133	Land Use										
Private Vehicles / Subway Rail Commuter / Surface local transit	Travel Modes										
Expressways and Rapid Transit facilities as shown in Figure A4	Transportation Facilities										
3 zone fares: 1 zone 15¢; 2 zone 27¢; 3 zone 35¢	Transit Fares		Doubled			Reduced 50%	Uniform 13¢	Zero			
Up to 5 miles 25¢; 5-8 miles 30¢; Over 8 miles 30¢ plus 3¢ per mile	Rail Commuter Fares										
1.65¢ per minute. Based on an average travel speed of 20 m.p.h.	Operating Costs	Reduced 50%									
Basic charges $0.50 to $1.50 for 8 hours No limitation of spaces	Central Area Vehicle Parking			Charges Reduced 50%	Base Demand Increased 50%				Charges Increase 50%		
Lot sizes: Subway stations 100; Commuter stations 500 Charges: Inside metro $0.80; Outside metro $0.50	Fringe Vehicle Parking										
Subways at 2 minute headways Based on 1956 level of service in relation to population density	Level of Transit Service										Service frequency & stops doubled
Subway speed 20 m.p.h. Surface speed proportional to car speed 12 : 17 m.p.h.	Transit Speeds									Increase 50%	
Average Speed 38 m.p.h.	Rail Commuter Speed										
Overall increase in zone incomes of 12% from 1956	Income Per Capita										
6 levels of transit service (minutes) 4-8-12-18-22-30 5 income groups $2050, 2400, 2640, 2900, 5000	Modal Split Classification										

TABLE 3B — DESCRIPTION OF INPUT DATA — GROUP 'C' STUDIES

FIXED INPUT DATA GENERALLY ASSUMED IN ALL GROUP 'C' STUDIES	INPUT DATA	VARIATIONS ASSUMED IN GROUP 'B' STUDIES					
		ROAD ORIENTED			TRANSIT ORIENTED		BALANCED
		C1	C2	C3	C4	C5	C6
1980 Draft Official Plan. Traffic Zones 133	Land Use						
Private Vehicles / Subways / Surface local transit	Travel Modes	Expressway buses	Rail Commuter		Expressway buses	Expressway buses and Rail Commuter	Express buses
Expressways—existing and committed at 1960 Subways—existing and committed at 1960 Figures 5A, 6, 7.	Transportation Facilities	Proposed Expressways			Expressway lanes for buses Extended Subway System Rail Commuter		Expressway and Arterial Express buses
3 zone fares: 1 zone 17¢; 2 zone 30¢; 3 zone 39¢	Transit Fares						1 zone 15¢ 2 zone 27¢ 3 zone 35¢
	Rail Commuter Fares		5 miles 28¢ 8 miles 34¢ + 3.4¢/mile			Same as in C2	
1.9¢ per minute. Based on an average travel speed of 20 m.p.h.	Vehicle Operating Costs						1.65¢ per minute
From $0.50 to $1.50 for 8 hours No limitation of spaces	Central Area Vehicle Parking						
	Fringe Vehicle Parking					Unlimited Capacity No charge	
Subway at 2 minute headways Surface transit 2, 3 and 6 minute headways	Level of Transit Service						
Subway speed— Surface— Expressway buses—	Transit Speeds	20 m.p.h. 14 : 17 20 m.p.h.	20 m.p.h. 14 : 17	20 m.p.h. 12 : 17	22 m.p.h. 14 : 17	22 m.p.h. 14 : 17 33 m.p.h.	20 m.p.h. 11 : 17 Vehicle speed
	Rail Commuter Speed		33 m.p.h.			33 m.p.h.	
Overall increase in zone incomes of 12% from 1956	Income Per Capita						
6 levels of transit service (minutes) 4-8-12-18-22-30 5 income groups $2200, 2570, 2920, 3250, 5000	Modal Split Classification						$2050, 2400, 2640, 2900, 5000

TABLE 4B — DESCRIPTION OF INPUT DATA — GROUP 'D' STUDIES

FIXED INPUT DATA GENERALLY ASSUMED IN ALL GROUP 'D' STUDIES	INPUT DATA	VARIATIONS ASSUMED IN STUDIES D1 TO D4			
		D1	D2	D3	D4
1980 Draft Official Plan. Traffic Zones 234	Land Use				
Private Vehicles / Subway / Surface local transit, Express arterial bus, Expressway bus	Travel Modes		Increase in Expressway bus route miles and decrease in Express Arterial bus route miles		
Expressway, Rapid Transit and Express buses as shown in Figure 8A	Transportation Facilities				
2 zone fares: increased 46% from 1961 1 zone 22¢; 2 zone 44¢	Transit Fares				
	Rail Commuter Fares				
1.9¢ per minute	Vehicle Operating Costs				
From $0.60 to $2.15 for 8 hours No limitation of spaces	Central Area Vehicle Parking				
	Fringe Vehicle Parking				
Subway at 2 minute headways Surface transit headways of 2, 4, 6 and 10 minutes	Level of Transit Service				
Subway speed 20 m.p.h. Surface transit speed proportional to car speed 17:10 m.p.h. Express bus speed same as vehicles	Transit Speeds		Express Arterial buses to subways 14:17 m.p.h.		
Subway to express bus 8.0 minutes (outbound) Express bus to subway 2.0 minutes (inbound)	Transfer Times		Subway to express bus 0.4 minutes Express bus to subway 2.0 minutes		
Overall increase in incomes of 18% from 1956	Income Per Capita				Zone incomes reduced to equal those of Group 'C'
6 levels of transit service (minutes) 4-8-12-18-22-30 5 income groups $2420, 2830, 3120, 3420, 5900	Modal Split Classification				Income Classes 22,00 2570, 2920, 3250, 5000

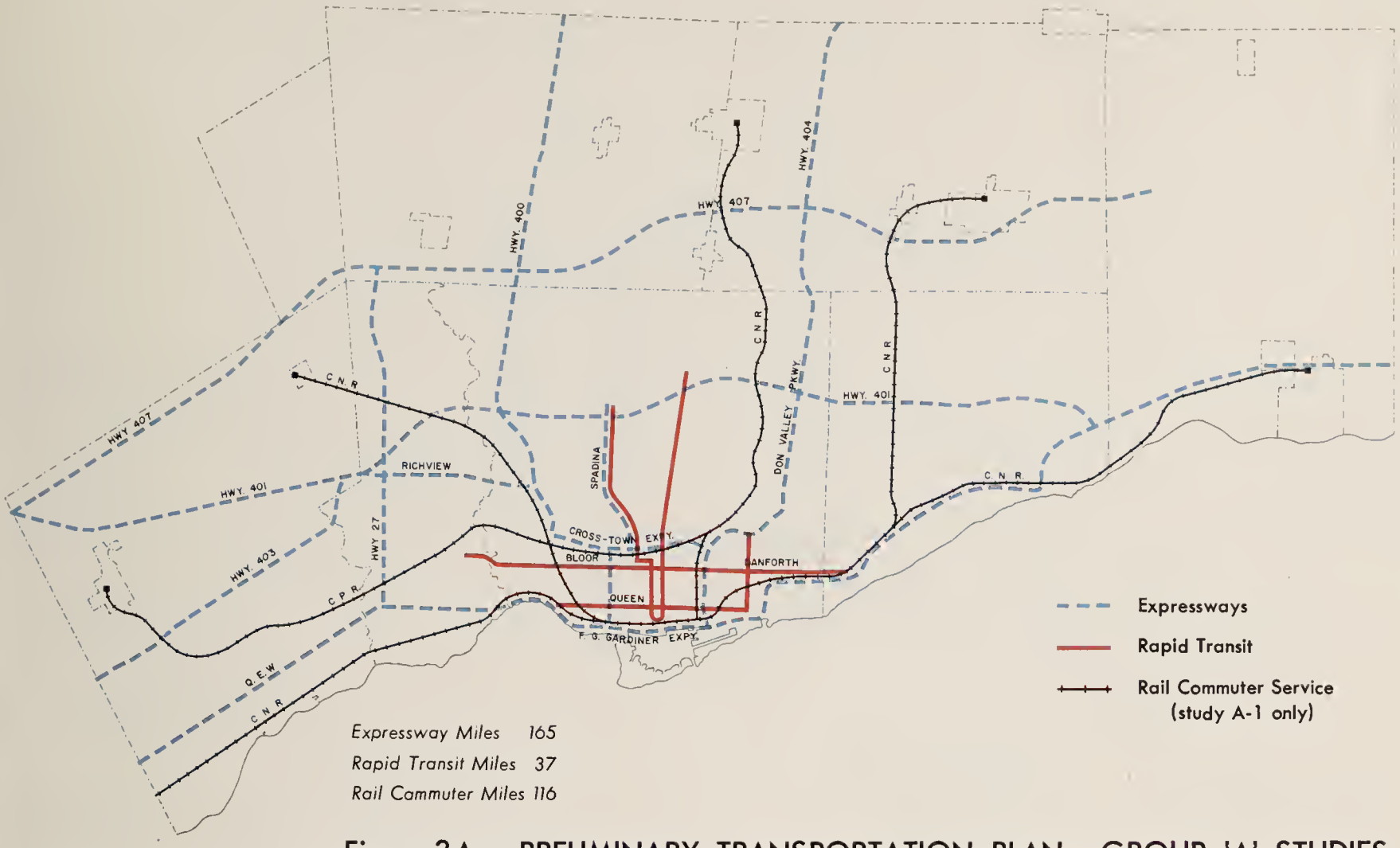
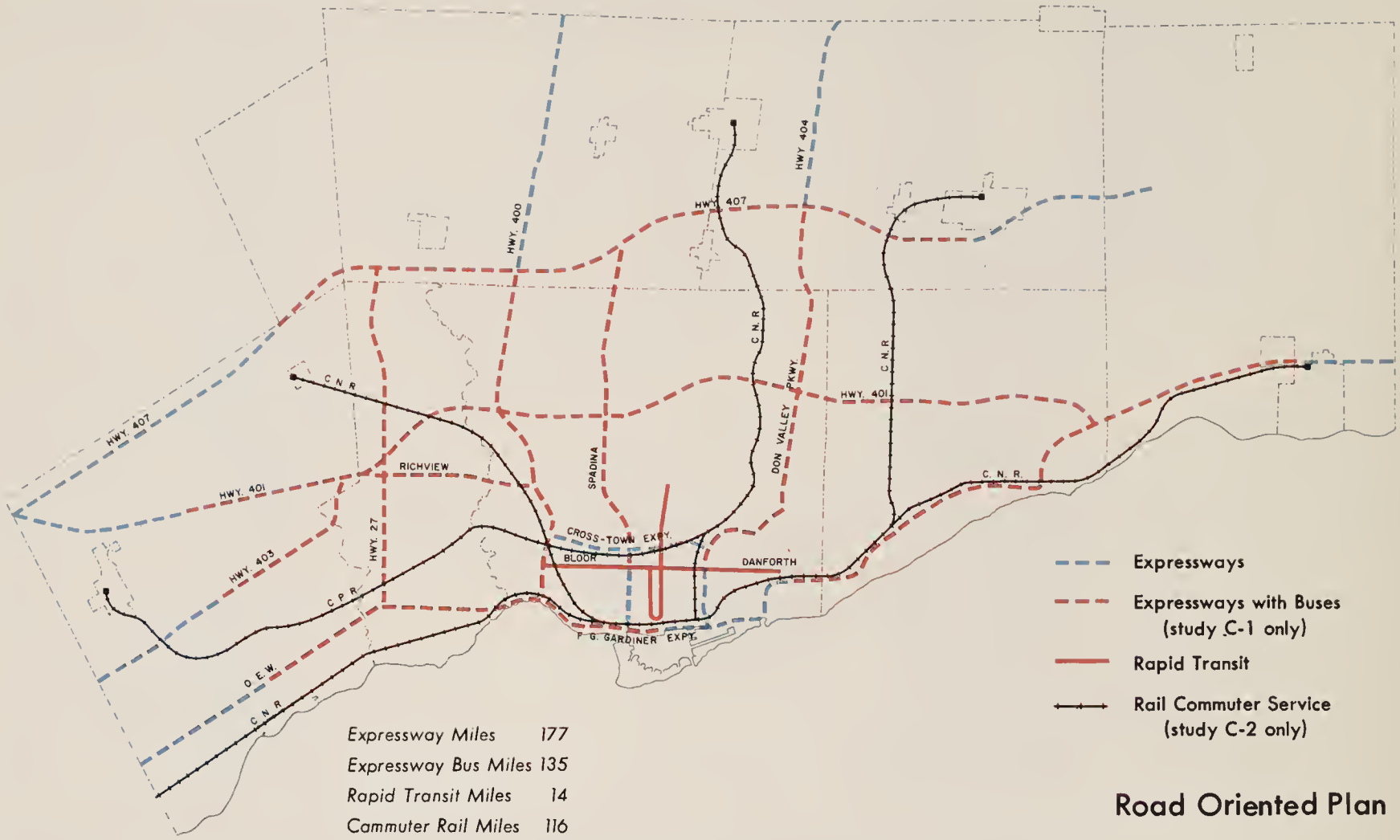


Figure 3A — PRELIMINARY TRANSPORTATION PLAN — GROUP 'A' STUDIES

(Draft Official Plan 1959)

Figure 4A — VARIABLE — GROUP 'B' STUDIES



Road Oriented Plan

Figure 5A — CONCEPT PLAN — GROUP 'C' STUDIES

Transit Oriented Plan

Figure 6A — CONCEPT PLAN — GROUP 'C' STUDIES

Balanced Plan

Figure 7 A — CONCEPT PLAN — GROUP 'C' STUDIES

Figure 8 A — RECOMMENDED FINAL PLAN — GROUP 'D' STUDIES